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THE PLACE OF NATURE STUDY, SCHOOL GARDENS, AND AGRICULTURE IN OUR SCHOOL SYSTEM.

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Among all the innovations in the education of the past half century, none have been of greater importance nor of greater value to our schools and the people at large, than Nature Study, school gardens, and the inclusion of agriculture in the school curriculum. Nature Study is a part of the adopted course of study in a number of states and is so widely spread to-day that it hardly needs an apologist; school gardens may be found in almost every one of our larger cities, in many rural schools in Canada, and in an ever-increasing number of country districts in the Middle West; while, as a national movement, agriculture is making greater strides in our elementary schools than is either of the other subjects under consideration, and agricultural high schools are flourishing entities in Wisconsin, Minnesota, Alabama and California. Hence the value, educational and extra-academic, of these subjects merits consideration.

Europe is the home of school gardens, and there to-day they are found in greatest numbers; the United States saw the beginning of the Nature Study movement which has spread over this continent and through Australia, New Zealand, Tasmania, Holland, and into England, but it is in Canada, at present, that the two are most thoroughly inter-correlated, and where the best work is being accomplished with them. The Educational Departments of Manitoba, the Northwest Territories, British Columbia, Ontario, New Brunswick, and Nova Scotia all prescribe instruction in Nature Study for elementary pupils; and in Nova Scotia and British Columbia it is provided that "the pupil must study the plant, the animal, and the soil, themselves, other

than book descriptions of them. He may only consult books after he has made his observations." About three years ago, when Sir William Macdonald established five consolidated rural schools in each of the five eastern provinces, there was included a garden at each school that "should be used as a large slate, for the *use* of the scholar, where he might see his example before his eyes, and which might be rubbed clean again as soon as the lesson was learned and another came up." These gardens have now been made a part of the educational system of each of the provinces, and the establishment of others is being encouraged by liberal grants. Over a hundred rural schools in Nova Scotia have gardens, and the movement bids fair to become Dominion-wide.

The thing which, above all else, assures solidity to this movement in Canada, is that it has been recognized that such plans have failed elsewhere because of the lack of suitable teachers, and this is being met by providing training for teachers before there is even a great demand for them. In Nova Scotia the provincial normal school is affiliated with the agricultural college, and all students receive instruction in Nature Study, school gardening, and elementary agriculture. Macdonald Institute, at Guelph, Ontario, gives more thorough and better instruction in these lines than can be obtained anywhere else in the world, special attention being given to the correlation of the other school branches with them, and to the bringing out of their true educational value.

The manifold importance of Nature Study and school gardens is indicated by the impetus given it from so many sides, by the fact that the movement is being promoted by a large number of organizations with widely differing purposes to further their own aims and to solve the problems of special importance to them. Naturally, its friends are most numerous in educational fields. The Committee of Five of the N. E. A. on Industrial Education in Schools for Rural Communities, recommend gardens for every school, and that Nature Study should be taken up in the first grade of each primary school, and carried on until the elements of agriculture may take its place in the fifth grade. Nature Study leaflets for free distribution among the school children and teachers are published by the state universities or agricultural colleges of at least nine states; the summer schools of the agricultural colleges of Nebraska, North Carolina, Connecticut, and possibly other states, offer courses for teachers, while such courses are given in Cornell, Hampton Institute, Tuskegee, all the state normal schools of Missouri and the District of Columbia, in most of those in Massachusetts, and in others in Connecticut, Vermont, California and Utah. Nature Study and gardening are compulsory in all of the Indian schools

and are used as a means for teaching many of the other subjects of the curriculum, especially English. The market is becoming almost flooded with books on these subjects, and competent lecturers are in the greatest demand for teachers' institutes, summer schools, and Chautauquas. The movement has been under way long enough to have proved that it is no mere passing fad; its importance, then, attests to its value as a factor in education.

What may this value be? That must depend largely upon the use to which the garden is put, and upon the meaning assigned to the term "Nature Study," for the value of elementary biology and physics is a far cry from that of happy little picnics in the woods or sentimental talks and readings about plants and animals. Teaching the child *how* to raise plants and vegetables is of immense importance, but should be anything but paramount; the development of the child and not the technicalities of gardening is what must be sought in our schools. As to the material for Nature Study, there are those who say it makes but little difference what that may be, so long as the child is led to observe it closely; the aim of such teaching is difficult to perceive, and its educational value would be minimal. Nothing should be *shut out* of Nature Study which is in nature and which the child is naturally interested in; something of astronomy, for example, ought to be given to the child, who is always a star-gazer, and whose first metaphysical speculations come when he is lying on his back in the blue grass or clover "just wondering." But on the other hand, nothing appeals so strongly to the child as does life, and its forces. His eternal question, "What makes it do so?" might almost be taken as the magnetic pole by which one may lay out the work to be followed. After pointing out that the purpose of Nature Study is "The learning of those things in Nature that are best worth knowing, to the end of doing those things that make life best worth living," Dr. C. F. Hodge in his "Nature Study and Life," goes on to show that the things best worth knowing, for this end, are fundamentally the relations of the individual toward nature and its forces, toward life in general, both animal and vegetable. Well taught and with this dynamic end kept constantly in view, Nature Study will produce the highest of all educational values: the proper response of the individual to his environment.

School gardens, in turn, give children the best possible means of giving expression to their thought through motor channels,—a thing which is essential to the motor-minded, and the educational importance of which for all children cannot be overestimated, for experimental pedagogy is showing us that representation is hardly second to perception in value. Schools in Philadelphia, Cleveland, Hampton and Boston report that

children having the advantages of gardening do much better work in their other studies than do other children in the same school; and in Dayton, Ohio, where school gardens have been conducted for six or seven years, the increased efficiency of the former class of children over the latter is some thirty per cent. Perhaps the school garden, through its correlation with other school work, may aid in bringing our American teachers to work always for the natural and harmonious development of the child, rather than to teach a number of separate subjects as such; if it shall do this, it will become the greatest uplift to our education for many years. Moreover, it has the advantage over all other school work of making for the health of the children, especially in cases of incipient tuberculosis, and it is for this reason that the movement is endorsed by the New York Male Teachers' Association.

We have noted above that the value of the subjects under consideration is not educational only, and that the movement is fostered by organizations of many kinds. Nature Study and school gardens serve better than do other things to "cultivate the critical discernment of beauty and excellence in nature and in human nature," as President Eliot of Harvard has pointed out; and it is because of this that the American Civic Association has organized a department to carry on the propaganda essential to a wide acceptance of these subjects in our school system. Newspapers, city civic clubs, college settlements, seedsmen, and local agricultural and horticultural societies are supporting this movement in various places.

The ethical value of producing something cannot be overestimated; in this lies the only road to altruism open to the child, as well as a guarantee of his respect for the products of others. The selfish child or man is he who has fallen heir to his possessions, and it is only when he has obtained the products of his own toil that he looks about him for a worthy object upon which to bestow it. In a number of our large cities, some experience in raising plants, vegetables, and trees, has resulted in a wholesome respect for like property of others, both public and private; care, time, patience and money do not mean much to a child until they have become a part of his life. "Best of all the results of the gardens of our Cleveland school children, some few of the most troublesome boys have found their natural line of interest, and seem to be quite reformed." School gardens have quite transformed districts in the slums of New York and Philadelphia, morally, socially and æsthetically.

The child himself becomes a life-long economic force in nature, as soon as he learns to look at it with understanding eyes. All too few country boys know how the roots of corn

spread, or what "smut" is; communities of boys, who before seemed the natural enemies of frogs and bumblebees, have come to conserve them upon learning their place in the economy of nature; the children of one school in Worcester, Mass., have almost wholly freed their end of the city from mosquitoes and malaria; by selection of seed, Minnesota school children have added to the wheat yield of large districts by a quarter. Any child would prefer an apple that is not wormy: let him learn the cause of wormy apples and you have a new force for good in the horticultural world, not to mention his changed attitude toward the birds of the neighborhood. The habit of looking the future squarely in the face, and preparing for it, is necessary to success in life; and it may be encouraged at a younger age by means of a dynamic Nature Study and by gardening than in any other way. Good eating apples appeal strongly to the child, but they cannot be secured unless precautions have been taken months beforehand,—and such examples are legion.

Important as are these subjects from an educational, ethical, and economic standpoint, their æsthetic value,—their effect on the sentiments of the child,—is overshadowed by none other. The country children may, and need to be, brought to appreciate the beauties spread all around them, the beauties which those from the city who are able, each summer pay large sums to enjoy. Prof. L. H. Bailey has pointed out that "even many country children too young to feel the appeal of more bushels of potatoes or more pounds of wool, have yet thus early formed their dislike for the farm. A flower garden and a pleasant yard would do more to content them with living on a farm than ten bushels more of wheat to the acre." In the city, Nature Study and gardening form the best vehicle for introducing the blessings which nature has supplied for mankind, but which paved streets, tenement houses and attendant conditions have denied to so many thousands who need them most of all. The psychological genesis of a genuine love of nature is the crowning result of Nature Study. The good teacher, moreover, will direct the religious feelings of the child to nature, with the certainty of appropriate response. There is nothing in nature which man has not worshipped, nor which primitive man to-day fails to worship: the stars, sun, moon, wind, clouds, water, rocks, flowers, trees, animals. President G. Stanley Hall urges that "The sentiments on which the highest religion rests are best trained in children on the noblest objects of nature." (*Vide* "Adolescence," Vol. II, pp. 144-232.)

Proud as we have reason to be of our agricultural colleges, we must confess that we are lagging far behind Japan and the

countries of northern Europe in supplying formal instruction in agriculture in elementary and secondary schools. All the rural schools of France, Belgium and Denmark include this subject in their regular curriculum, while Norway, Sweden, Germany, Austria, Hungary, Finland, Switzerland and Holland support large numbers of agricultural schools of both primary and high school grades. The movement toward the maintenance of such schools in the United States is well under way, and is showing marked progress with every year. Agriculture is taught in all the rural schools of Nebraska, Wisconsin, Alabama and Illinois, and in nine-tenths of the counties of Missouri, while the teachers of Maine, North Carolina, South Carolina, and Tennessee, if not of other states as well, are obliged to pass an examination in this subject to obtain a certificate. The state boards of education of Indiana and New York are at present recasting their course of study, so as to include this work for the rural schools. Various county superintendents of schools over the Middle West, who felt it hardly feasible to introduce agriculture into the school curriculum at present, have organized Boys' Agricultural Clubs, the members of which compete in raising grains and vegetables—in Illinois, they have a corn judging contest as well—and at an annual fair in the autumn the exhibits are judged by professors from the state agricultural college, and awards made. By this means hundreds and thousands of children of Iowa, Illinois, Ohio, Texas, Kansas, and other neighboring states, have of themselves acquired a hunger for agricultural learning so insatiable that their teachers have been forced to take up the subject, in self defence, if for no other reason. In many cases, an annual visit of the club members to the agricultural college of their home or adjacent, state has been made, as one result of which many children have been made to aspire to, and to work for, a higher education than would have been the case otherwise.

There are some few primary schools in the United States in which the basal instruction is agricultural, where the boys are taught, young as they are, to become practically self-supporting and so independent, but without formal education being neglected; schools very like the famous Abbotsholme in England, in that their one purpose is to "train up MEN," as M. Demolins puts it in his book on Anglo-Saxon Superiority. Almost without exception, however, they are Farm Schools for indigent boys, or for waifs not yet vicious but who have been committed for vagrancy. Best of all these schools, and a veritable object lesson in what education ought to be, is the Boston Farm School, on Thompson's Island, in Boston harbor. The only fault one can find with the institution is that

only indigent boys are admitted,—no indulgent father could buy its advantages for his son with any amount of money. A number of analogous institutions might be mentioned, but space remains for but one: the Berkshire Industrial Farm, of Canaan Four Corners, N. Y. It is worthy of note that this school is for "unruly, vagrant and vicious boys," for just those who are shut out of other schools. Manual training along other than agricultural lines is taught, but Supt. Mayo has not found so good effects from any other line of teaching as from agriculture, and from teaching the boys to make an honest living for themselves, out of doors, and in the country. During its history of over twenty years, only a negligible per cent. of its boys have failed to be transformed into good men and good citizens.

A catalogue of our secondary agricultural schools does not consume much space. Here must be reckoned the 16 land-grant schools for colored people, in the South, for only about four per cent. of their students are seeking the bachelor's degree. Alabama supports one agricultural high school for whites in each congressional district. Wisconsin has two county high schools of agriculture, manual training and domestic science, and has lately appropriated funds for two more; California has a state secondary school of this kind at San Luis Obispo; and Nebraska, Maine, Rhode Island and Washington have followed the lead of Minnesota in establishing secondary schools of agriculture in connection with their agricultural colleges. Something over half a dozen private secondary schools give more or less thorough courses in agriculture and horticulture. The government has established an Indian school of this class at Chilocco, Oklahoma, where hundreds of boys and girls from the elementary Indian schools can be accommodated and taught scientific farming.

Meagre as this agricultural instruction has been, its results have been enormous. Take the work of Hampton Institute, Tuskegee, and the land-grant schools for colored students, as an example. In every southern state, graduates of these institutions are conducting small industrial schools, which pay special attention to agriculture, each forming a centre of progress for the negro. During the last 25 years, more than 70% of the negro farmers of the 33 counties of tidewater Virginia, have come to own and to manage their own land. These schools have been sending out missionaries, not to preach an emotional religion through the medium of "revivals," but to preach the gospel of work, of land-owning, and of scientific agriculture. Every other race has had to dig its civilization from the soil; perhaps the negro will be obliged to do likewise, especially since he is being driven out of the mechanical trades

by the spread of trades unionism. But cotton and tobacco are his staple crops, to such an extent that in thousands of cases he fails to raise any kitchen vegetables for his own use. Diversified farming would keep him from loafing half the year, and scientific farming taught to every colored boy and girl would do more to raise the race economically, and hence ethically and socially, than will all the classical education that can be furnished. The same thing is true of the Indian,—agriculture taught to every pupil in the elementary schools of the Indian service has done more to bring the race up to the standard of American citizenship than has any other one factor.

That an agricultural education is of as great value for the children of our own rural schools, is proved by the continuous spread of such instruction and of the facilities for giving it properly. Although half of the school children of the United States receive all of their instruction in the country schools, they are educated away from, rather than up to, their life work. The introduction of agriculture in the elementary schools, especially where it has been made to furnish the subject matter for other of the school studies, has aroused a wholesome interest in the whole of the school work such as has never before been seen. Many of the children attending the agricultural high schools would never have gone to another secondary school because of lack of interest. Perhaps the greatest commendation these schools have received, is that the farmers of the surrounding regions call them "*our* schools."

Serious objections have been raised in several states to the Wisconsin plan of one agricultural high school to a county, because of a belief that the existing system of public high schools should not be paralleled by schools more or less technical; that "it is wrong to set agricultural instruction off by itself, and to make it only a class subject." It seems only a question of time, however, until agriculture shall be a common feature of our educational system, higher and lower alike. But the present need for secondary instruction of this kind is imperative, and if it is to be met before the establishment of county agricultural high schools seems feasible, there confront us but two possibilities: the introduction of the subject into all our public high schools, or, the practical abolishment of entrance requirements to the agricultural college. Lack of trained teachers makes the former out of the question for the present; hence it seems that the latter course should be followed. This does not mean in the least a lowering of a standard for a degree, or, better, for graduation. Happily, there is an instance in point to serve as an example. Just as the Missouri agricultural college doubled its number of students by raising the entrance requirements to a level of those of the college of arts and sciences, so,

on the other hand, Illinois in six years increased the attendance from 20 to 340 by providing a large faculty, competent in every way, and then saying to the farmer boys of the state, "Come to the University, as you are, and choose the subjects you wish to study. We teach about 80 agricultural subjects, elect what you feel you need, and we 'll do the best we can to teach them to you. Of course, if you choose certain subjects, you must take certain others with them, because they belong together." And the boys go to college without very much thought of the degree, but rather to learn those things they have found they needed to make them successful farmers.

No serious student of our American system of education would defend the conditions in our rural schools to-day, as being the best to prepare the pupils for successful, happy lives, or for the highest citizenship. Many reforms would be necessary to supply adequate educational facilities to the pupils of our rural schools,—nearly one-half the school children of the country. More than nine-tenths of the country school children never attend a graded school. Whose is the fault, we need not stop to inquire; but not only do these children have the right to demand better training, the Nation has the right to demand better citizens than is possible under the present conditions. In some parts of the South, if not in most of the southern states, the condition of the people forbids sufficient local taxes being levied to support good schools; but, in many parts of the country, the educational ideals of the people of well-to-do sections must be lifted. In the Middle West, for instance, the indifference towards education seems best met by showing the people the financial advantages to be secured through scientific agriculture. There are not a few examples of counties—indeed, of states—where the farmers are now leaders in the demand for a better and higher education; more bushels of wheat, corn and potatoes to the acre have accomplished what the continued pleading of school men failed to do.

Our first schools were for the express purpose of training young men for the ministry; and from the very foundation of the United States the curriculum of our elementary schools has been tailor-made, according to fashions prescribed by the classical colleges. The conservatism which has cut out a course of study to fit the five per cent. of the elementary scholars who go on into high school, and which forces the remaining ninety-five per cent. to wear a misfit or to go without intellectual clothing, is scarcely worthy of our progressive spirit along other lines. Instruction in agriculture would force none of the present subjects out of the rural schools (although its introduction might be justifiable even if it did), for several of the subjects could profitably be pruned down perhaps a quar-

ter, as Dr. McMurray has shown. Indeed, most of our text-books to-day are manufactured to suit every possible superintendent, who wants certain features included, and who has no qualms against cutting out those other parts which he does not think valuable. A proper correlation of agriculture with the other studies would furnish plenty of material for school use which would mean more to the children than would text-books, especially in arithmetic, compositions, etc. For example, a Wisconsin boy living near one of the agricultural high schools, whose father scouted the theories of the school, had two pigs, and he went to one of the instructors to learn how best to feed and care for them. They did better than did any of his father's pigs, and compositions, always greatly dreaded before, now came readily, in each of them a naïve account of the progress in the conversion of his father.

Most of the pupils in our rural schools have but two sources of information: the world around them, and books. It is sad to think how little many children get from either. Nature Study in the earlier years teaches them to observe, inference gradually comes in as the child combines his observations, until in the higher grades he reasons from cause to affect. Until within the last two decades, the education of our schools was confined to thinking, the doing was limited to work with pen or pencil. Manual training is now recognized as of great educational value, but the impossibility of suitable equipment for wood, clay, and iron-working, has kept our rural schools still in the old ruts. School gardens make good this deficiency, and furnish the first means for co-ordination of mental and motor activity. As the child grows and his interest enlarges, he should be given larger opportunities for determining, guiding, exercising and controlling his motor activities; the work of the Boys' Agricultural Clubs is a good example of what may be done toward this end, and the increased attendance of scholars just from the rural schools upon the more elemental courses of the Illinois agricultural college shows the result in only one direction.

There is almost as much need of Nature Study with an agricultural trend, of school gardens, and of agricultural instruction, in our city schools, as in the country. Before the introduction of manual training, our educational system had made no provision for those pupils of a distinctly motor type. Through this means, many children are now being lifted to a higher plane of life than before; and the introduction of gardening into the schools of cities of considerable size has saved large numbers of others from dropping out of school without any broad life interest, and with but a small part of what the school should have given them. There are, moreover, in the

schools of all our cities surrounded by farming or horticultural industries, a considerable number of children who must eventually gain their livelihood in such work, to say nothing of the pupils from rural communities who come into the urban schools because of their superior advantages. Certainly, if the aim of education is to fit for life, these boys and girls should be taught according to their needs, and not along some hard and fast course of study mapped out for those who wish to prepare for college. A large number of our cities now have manual training high schools, for children needing such training as they give, and it is right that it should be so. There is even more justification for the teaching of scientific agriculture, since it would tend to check the congestion of our cities, while the former has exactly the opposite trend. One extra teacher in a high school could give instruction in agriculture, open, to those who cared for it, as part of an elective course, along with most of the other scientific subjects, but with less language. Dr. True suggests that in case a small city inaugurated an elective course in agriculture, the outlying rural districts should help pay the expenses accruing, and send their common school graduates there for further study.

It is not possible to consider the need of a good education for children of rural communities, without touching, at almost every point, some argument for the educational value of agriculture, as such. Before formal schools were thought of, the race made its progress by studying nature and by manual training; later the school came in to supplement these, and finally usurped their place altogether, and absorbed the entire time of the pupil in the consideration of books. Every race has dug its civilization out of the ground, and that our children need to follow in their footsteps, in this regard, at least, is becoming more apparent with each mark of progress made by gardening and agriculture in our schools. It is time for us to ask, with Demolins, "Do our schools make MEN?" Are they helping to maintain the superiority of the Anglo-Saxon? Few visitors to Hampton, Thompson's Island, or the Berkshire Farm School do not remark, wistfully, "How I wish I might have spent my school life in such a place!" Thompson's Island will not take a depraved boy, the Berkshire School takes but few who are not; both, alike, turn out efficient young men. Hampton and kindred schools are reforming the South educationally as well as materially and morally, and they believe their best work is done through agriculture and gardening. It cannot be too strongly emphasized that scientific agriculture contains as great educational values, disciplinary and otherwise, as do, perhaps, any other means available at the present time. We have long believed that the painter, the designer, and the

sculptor, express the highest form of thought in their handiwork; more recently, we have accepted working in clay, wood, or iron, as true expressions of the intellect. In the same way, exact and well-ordered thought is required in the problems of the farm, in bringing the various kinds of soil to the maximum of productivity, in the handling of complicated farm machinery, in expert butter making, etc.

Indeed, the value of elementary agriculture in the common schools is now recognized in many parts of the country, and each year sees its introduction into one or more states. It is natural that this should be so, long before there is much agitation for the introduction of agriculture into our high schools; for a technically trained teacher is not absolutely necessary in the elementary school to make the instruction valuable. Perhaps it is even wise to have such a study as this, in which the pupils may know almost as much as their teacher, who shall study with them, only using his larger powers for the skillful guidance of the children. To make a success of school gardens without having had experience with gardening is more difficult than to teach Nature Study without suitable preparation, but with foresight and pertinacity it can be done. In those States which have made such instruction mandatory upon elementary teachers, there are hundreds of cases of teachers who have made a success of teaching even elementary agriculture, although practically not at all trained for the work. But this is impossible in the secondary schools, although the need for such instruction is equally as pressing. Here, there must be trained teachers to assure scientific instruction.

If there were, in the early days of our agricultural colleges, any justification for their establishment, there is as much to-day for the foundation and maintenance of secondary agricultural schools. The advocates of the first Morrill Bill never dreamed of the early opening of a distinctly university field of agricultural work; on the other hand, the colleges were meant to train up skillful farmers. But they have so kept abreast of the wonderful progress made in the science of agriculture, that, except for their short and special winter courses, they do not to-day pretend to do much more than to give to the world a body of trained leaders, of experts in various lines. The great gulf between the elementary agriculture of the rural school and the collegiate work of our higher institutions demands bridging,—and our farmers have a right to demand it. Some of the state universities of the West are urging the placing of agriculture in the public high schools; to others it seems better to establish separate agricultural high schools, at least for the present, when we have no body of suitably trained teachers to place in all our secondary schools. The Committee of Five

of the N. E. A., but one member of whom might be an expert in agricultural education, concluded as to agricultural high schools, "the character of the work already done in the existing schools of this class, the interest they awaken, and the hearty support they receive from the agricultural communities maintaining them, the history of these schools in foreign countries, the value of their work both for disciplinary and practical purposes, all combine to present the strongest reasons for the organization of schools of this type in large numbers, in agricultural communities. . . . . In our opinion, the establishment of schools of this type is an absolute necessity for the proper development and organization of the rural school system."

A last argument, but by no means the least, for the educational importance of agriculture in our schools, is that in France and Belgium its introduction has materially raised the age of leaving school, in many sections "from two to three years," the governments say. What statistics we have in the United States go to show the same result; in the agricultural high schools of Alabama, Wisconsin and Minnesota there is constantly a good per cent. of students who would have dropped out of school with only an elementary education, had there not been the opportunity to learn of the things in which they were naturally interested. Agricultural high schools would be worth all they cost if they were attended only by those young people who otherwise would have finished their formal education with the elementary school.

The economic value of instruction in agriculture may seem to be so well recognized as to demand little more than a statement of its importance. But the essential thing to note is that our rural schools have not kept up with the wonderful progress made in agriculture. Our experiment station workers are constantly discovering facts of the greatest importance to the masses of farmers, but the new truths are surprisingly slow in seeping down into the soil needing enrichment. Every farmer boy ought to be taught how to choose the best seed corn; but it was because of the impossibility of this information reaching the people of the Middle West through the schools, that the railroads had to adopt the makeshift of carrying agricultural college lecturers over their lines, who taught as many farmers as could be gathered together how to raise a fifth more corn each year through the careful selection of seed. As a result, Iowa alone has added $8,000,000 annually to her income, and one could not estimate how much more this would have been had all the homes in the state been reached through the schools. The Boys' Agricultural Clubs are assuming something of this function, with the consequence that some Illinois

boys are able to sell their corn for seed for five times as much as their fathers can command.

The economic necessity of such instruction is all the more imperative because even a farmer cannot live unto himself and be successful. Half of our total exports are agricultural products, and our farmers must have good markets abroad to reap rich returns for their crops. Science, however, knows no geographical boundaries, and the latest discoveries bearing on agriculture are taught in the elementary and secondary schools of several of the European countries, as we have seen. Moreover, in a monarchy a change in the educational system works from the top down very quickly,—witness the New Code of 1904, in England, where the elementary course of study was made to hinge on Nature Study with a very agricultural tinge, although a few months previous England was behind all Europe in such teaching. In practically all the European states, the government provides travelling schools and itinerant instructors for the teaching of new methods of production to young and old alike. Sweden each year selects scores of her more progressive farmers, one from a locality, and sends them on a visit to the better farms and experiment stations of the surrounding countries; on returning, each of these men acts as a centre of information for his entire community. It is just in this way that the European farmer is enabled to compete successfully with us. For example, he buys our entire surplus of cotton seed, very cheaply, and feeds its meal to his cattle, thus making him a successful competitor of ours in beef, while our Southern farmers did not recognize the value of cotton seed meal as a fattening product for a long time after its demonstration at the Tennessee experiment station.

The Danes receive $8,500,000 a year more for their bacon, butter, and eggs than England pays to any other country for the same amount of such produce, although twenty years ago, before the children of the country were generally taught about such things, the Danish products received less than the market price. Prof. G. L. McKay, of the Iowa state college, found Danish butter in England constantly bringing two to three cents a pound more than any other butter, because of its dry, mealy appearance. Investigation, however, proved that the butter in question actually contained two to three per cent. more water than Canadian or American butter. In other words, the Danes get two or three more pounds of butter from each 100 lbs. of butter fat, and yet sell it for two or three cents a pound more. Why? Because they have found the secret of making butter containing this extra amount of water appear to be extra dry, and the process is taught in the Danish schools. The farmers of Ontario have doubled their output since the

founding of the Ontario agricultural college, without any appreciable increase either in population or acreage. The money value of an agricultural education was recognized by Mr. Joseph Chamberlain, when he said before the House of Commons, while advocating a liberal appropriation for agricultural teaching in the West Indies: "I regard the whole of this cost as being an expenditure intended to relieve the British government of future charges."

The prosperity of our farming districts and states is not alone in demanding scientific training for our future agriculturists and horticulturists: the welfare of our cities and of our great manufacturing states is dependent upon the agricultural prosperity of their surrounding territories to no slight degree. It would be of inestimable value to the factory employees of New England, if the abandoned farms, with which the states are dotted, could be made productive and economically valuable. Urban conditions in the South would be materially bettered by increased productiveness of the surrounding country, which can readily be brought about by a better education of its owners and tenants as to how to deal with their land. Intensive farming is already being made profitable in rock-ribbed New England on land once abandoned as not worth the taxes imposed, and scientific agriculture has netted a gain of $96.22 on an acre of the poorest land in Alabama. One of the Tuskegee Farmers' Leaflets tells how Mr. G. W. Carver raised 266 bushels of sweet potatoes on one acre of land, with a net profit of $121, while the average yield in the vicinity was 37 bushels per acre. "The average yield of cotton throughout the South is 190 lbs. per acre, usually below the paying point. Every acre can and should be made to produce 500 lbs of lint. However, if every grower added but five pounds an acre, it would be worth $15,000,000 (1903 prices) more than at present."

Blinded as we are, too often, by our utilitarian tendencies, and our search for the practical, it may seem at first rather strained to lay much stress on the ethical value of instruction in agriculture, but I am convinced that it is of supreme importance. Instances might be multiplied *ad libitum* of transformations in character wrought by school gardens, to say nothing of the love for God's out-of-doors and for His creatures, coming from Nature Study. Police officers and courts in New York, Philadelphia, Cleveland and Dayton, O., among other cities, are glad witnesses to the civic virtue arising out of the proprietorship of a little piece of land. Respect for others' property is engendered in no way so quickly as by letting a child possess some of his own, while economy, honesty, application, concentration, justice and the dignity of labor are

brought into the children's lives in a telling way. A study of the laws of nature may well teach one that "Whatsoever a man soweth, that shall he also reap," in his life as well as from the soil. In working through a long season, side by side with others, the child gets his earliest and best instruction in social responsibilities, in what he owes to his neighbor, one of the most important things an individual of to-day has to learn.

Early experience in success and failure, and the learning to plan for the future and to work in expectation of reward later, are among other benefits of instruction in agriculture, and with these goes the consciousness of one's power to create value, to take care of himself in any crisis, to be independent when thrown on his own resources, "The ability always to fall on his feet." As a corollary there will come an added respect for farm and for the farmer, a thing greatly needed in America, where agriculture does not command the prestige which belongs to it in other countries. The country boy whose principal acquaintance with the soil has been unreasoning work with it, is not attracted back to it for his chosen residence after being called "Farmer" by the contemptuous boys of the town. Both urban and rural people need to be educated in this respect, although our agricultural colleges have wrought a great change for the better, for they are no longer satisfied to train men to be able to produce more grain to the acre, or more pounds of meat from a suitably balanced ration, but the students are being shown how they may become leaders among their fellows; how they may "make agriculture a live progressive art, which in the future shall provide a more stable and satisfactory basis for thrifty, intelligent, refined and happy rural communities, as well as a stronger guarantee for the manufactures, commerce, literature, art and science of a higher civilization."

Along with the better ethical condition which would result from an agricultural education, the religious instincts of the child or youth may well be appealed to, and healthfully stimulated. It is inconceivable that one could study nature, the out of doors, God's handiwork in the world, and not come to a truer reverence and love for Him who made all things and the laws by which they are governed. A most appropriate motto for a school of agriculture of whatever grade, or for any text-book unfolding the wonderful processes which man can bring about in nature, would be "Open Thou mine eyes, that I may see wondrous things out of Thy law."

Inseparable from a better ethical status of any considerable group of people, is the changed social condition of the entire larger group. It is because of the certainty of improved social conditions that such organizations as the American Civic Federation are putting forth their best efforts for the introduction

of gardens into our city schools, and of elementary agriculture into the schools for rural communities. It goes almost without saying that anything which exerts a favorable influence educationally, economically, and ethically, will be of value socially. In addition, however, there may be pointed out several specific social problems confronting us to-day which, theoretically, a general education in agriculture ought to bring nearer a solution, and which practical experiments show may be done in reality.

We have already noted the change of character among the Indians brought about since the introduction of agriculture in the curriculum of their schools; more than 25% more Indians are self-supporting now than before, and around the tepees of the blanket Indians, even, little gardens are appearing, here and there, which means a relinquishing of the nomadic life and the rise to a higher plane of civilization. The numerous farm schools over the country, including the large secondary school of St. Joseph's Directory, of San Francisco, have turned scores and hundreds of youth out of the highways of crime into paths of industry and good citizenship. A large increase in the number of such schools would mean not only the prevention of crime, but the lessening of tramps and pauperism. Sociological studies of the past decade have shown that a negligible per cent. of our tramps have ever tilled a foot of soil. Agriculture is the one occupation which is not at present deplorably overcrowded, and in which there will be a place for at least twenty years to come, for every intelligent, strong man to make and to keep himself independent.

The most serious difficulty with which the American farmer has to deal, especially in manufacturing states or localities, is that of securing labor for carrying on his work. This is not confined to any particular section; New England and Kansas alike are crying for help. A locality of considerable area comes to mind where a great majority of the young men have left the rich farms of the surrounding country, to live in miserable little homes in the towns and cities, where they work in zinc smelters amid the heat and fumes of sulphur, prodigal of their health and strength, although they know full well how soon a smelter employee breaks down. The same thing is seen in the factory districts of the south, and in rural New England. This would not occur to such an extent were it not that our rural schools are at present largely devoted to educating the children away from the farm,—and in farming districts of uneducated people, one cannot blame the young people for getting away from such conditions as soon as possible.

France and Belgium, among the European countries, have set the tide of population distinctly toward the country since

an elementary agricultural education was made compulsory; their census statistics prove it. In such of our own states as Illinois and Iowa, for example, where agricultural education is in its most flourishing condition in the United States, the young people are proud of their homes and of their farms, and with good reason. They go through high school, with the intention from the first, often, of going on to their agricultural college and of learning how to do better with their home farms than their fathers have done before them; not alone to learn how "to raise more corn, to feed more hogs, to buy more land, to raise more corn," etc., *ad infinitum*, but how to live on a social and intellectual level with their cousins of the city. It is not so much because their land was originally rich that these farmers have been able to make it worth from $100 to $150 per acre for farming purposes, to have country homes with all modern conveniences, to send their children to college, and to have a piano and the best reading matter in every home; but rather that they have *learned* how best to use their land. A few years ago several colonies of people from two of the richest agricultural counties of Iowa sold their farms for $100 or more an acre, bought Kansas farms for half as much, and are now raising as good crops as before, thus doubling their money. It is largely because of the added social advantages which a good agricultural education gives that the farmers of the Middle West are so proud of their agricultural colleges, and of such agricultural high schools as those of Wisconsin and Minnesota.

The American Institute of Social Service is conducting a propaganda for the establishment of schools "for children of weak and undeveloped constitutions, whose power of resistance is small," where the buildings shall be surrounded by trees, and where gardening shall be the particular feature. Such schools are well known in Germany, where they have proved of especial value in preventing tuberculosis. The largest of them, at Charlottenburg, accommodates 120 children, who are selected by the board of health; and according to the report made to the Tuberculosis Exposition in Paris, in October, 1905, over 70% of their pupils have been entirely cured or greatly improved, while less than 2% grew worse after admission. A recent editorial in Harper's Weekly reports organized opposition from the Gardeners' Union in Germany, to the prescription of gardening, by physicians, for anæmia, neurasthenia, chronic bronchitis and chronic gastritis, a treatment now becoming rather common, because gardening, "being found useful in curing the sick and building up the weak, will tend to make a large number of such people immediately become gardeners." The district nurses of some of our American cities report much better health among children at work in school

gardens than before such work was undertaken,—a thing of no inconsiderable importance to us as a people.

What seems at present to be the most hopeful sign of all, however, is the closer alliance of progressive agriculture with our system of elementary education. The teachers of rural schools are coming to attend the farmers' institutes, while the farmers, in turn, give closer attention to school conditions in their midst. In a number of instances, the state universities and the state farmers' institutes are working hand in hand for the making of efficient men and women from the country children. Of course, this largely means an agricultural education, and we have seen at some length, the value which such an education has proved to have, at home and abroad. Wherever tried in the United States, whether in elementary or in secondary schools, it has more advocates to-day than ever before. More states are introducing it into their public school systems; where it is now a matter of local option, the farmers of counties adjoining those in which agriculture is taught, are demanding a like education for their children. The offering of agricultural courses for teachers by normal schools and colleges, reflects the demand for them. Minnesota and Wisconsin have each within a year doubled the number of agricultural high schools receiving state aid. The Indian service has established a strictly agricultural Indian school in Oklahoma. The bright spots in the South have been made such by agricultural education. The Macdonald Institute, at Guelph, Ontario, marks a final step in advance by keeping the supply of thoroughly trained Canadian teachers abreast of the demand for instruction of this kind.

We are in the midst of a new and great interest in rural development, in farm life, in the achievements of science in agriculture. This has come along with, and perhaps partly as the result of, the rapid increase of facilities for intercommunication among the farmers themselves, and between them and the towns and cities of their localities. Rural free delivery gives the farmer his paper and other mail matter, delivered daily at his door. A mesh of telephone wires is binding together the homes of our agricultural population,—often a larger proportion of the farmers of a county have phones in their houses than have the residents of a city. Electric railway lines are threading their way past the doors of the country homes, and increasing greatly the facilities for travel. The progress in farm economics is reflected in the modern homes, and in more pleasant habits of life than have ever obtained before. The children and young people are receiving a better education; in several of our states a more practical and useful one, also; often they are carried in warm, dry vans to a consolidated

school, where they have the advantages of a graded school, competent teachers, and a hygienic building. Consolidated schools are spreading as fast as many other educational advantages of recent introduction, and, the country over, not one has been abandoned after being tried.

Progress in education among the rural masses has not been so prompt as in some of the other lines indicated, but we may be sure that, in the future, it will not lag far behind. It would not be safe to say in exactly what shape this development will take final form, but, from what we have seen above of the ever-increasing growth of Nature Study, gardening, and agricultural instruction in our schools, we may be certain that eventually all three will be taught in our rural schools, and the former two in all of our city schools; while the agricultural high school will become an indispensable feature of our American school system. Whether the ideal of a graded curriculum from the beginning of the primary school, on through the agricultural high school and up to the graduate courses of the agricultural colleges shall obtain, perhaps may not be predicted, but certainly it is a consummation devoutly to be wished.

THE HYGIENE OF THE TEETH.

By Wm. H. Burnham.

"A tooth is more valuable than a diamond," said Cervantes; and wealthy, we may add, the man who has thirty-two. There is a German proverb to the effect that half of digestion is done by the teeth. "Gut gekaut ist halb verdaut." It should be added that indigestion also begins in the mouth. A child's digestion, a child's temper, a child's general health depend largely on its teeth. The work done in a schoolroom, the discipline of a schoolroom, even the odor of a schoolroom, depend in great measure on the condition of the children's teeth. In recent years the teeth of school children have been the subject of many investigations which emphasize the importance of their hygiene. Among these are the following:

In 1877 Odenthal reported in Germany a study of 987 children, among whom he found 72% with diseased teeth.[1] In 1887 Ottofy[2] investigated the teeth of 623 school children in Dakota and Illinois and found in a total of 14,000 teeth 30% defective. In 1893 Pedley, in England, published the results of more extended investigations. 3,145 children were examined—a total of 70,000 teeth. 22.5% of the children had perfect teeth. 77.5% had defective teeth. Of the total number of teeth 12.8% were defective. He estimated that about two-thirds of these could be saved by filling. Hence he strongly urged (the first perhaps to do this) that dentists be appointed to each school, with sufficient pay for their services. In the same year, 1893, Unghvari, a Hungarian physician, investigated 1,660 pupils, of ages from 6 to 12, and found 87.2% with defective teeth. 23,906 teeth were examined,—of these 15.4% were defective.

Since these pioneer investigations many studies of the dental condition of school children have been made. Of recent investigations the following are representative and give typical results.

A study of the teeth of school children was made a few years ago by the association of dentists in the province of Schleswig-Holstein, Prussia.[3] 19,725 children, from 6 to 15

[1] Cited by Jessen, p. 438. See Bibliography, No. 8.

[2] For this and the following see Röse, Zeit. f. Schulgesundheitspflege, 1895, No. 2; also 1892, No. 5, pp. 233-234, and 1893, No. 2, p. 100.

[3] Zeits. f. Schulgesundheitspflege, 1900, No. 7.

years of age, in 19 cities were examined. Of these 95% were found afflicted with caries. Only 218 children had ever been treated by a dentist. In Kopenhagen[1] among 10,000 pupils 92.7% had defective teeth; in Halberstadt[2] among 1,303 nearly 100%.

Dr. Karlewski investigated the teeth of all the children in the Peoples Schools in Rheydt.[3] Among 5,300 children he found only 4.37% with completely healthy dentition. In an investigation of 9,557 children in the Peoples Schools in Augsburg 99.41% were found with defective teeth. Only 0.59% were free from caries.[4] Dr. Kielhauser, of Graz, in a careful investigation found from 67% to 82%. Gawronsky, in Gymnasien for girls in Moscow, found from 90% to 97%. More recent investigations have also shown that most children have diseased teeth, although in a few instances smaller numbers have been reported. In Leipzig, for example, where for several years there has been medical inspection, the percentage with defective teeth reported for 1901 was only 44.3%.[5]

An important investigation has been made in this country by Supt. Johnson.[6] "Four hundred and ninety-seven school children in Andover were examined; 257 boys, 240 girls, from four years of age to eighteen. 96.9% of all the children were afflicted with caries. Only 15 children: 9 girls, 6 boys, had perfect teeth, and all but two of these were under nine years of age. 31.4% of the teeth were diseased: among the boys, 32%; among the girls, 30.8%; 41.7% of the temporary teeth, 26.5% of the permanent teeth."[7]

At the International Dental Congress at Kopenhagen, in the year 1895, a report was made to this effect:[8] The number of school children suffering from defective teeth amounts in civilized lands nowhere to less than 80%, and rises to 98.5%. For most localities this seems to remain a conservative estimate today. Jessen's table for different countries gives the number from 65% to 100%.[9]

The studies already made show certain interesting correlations.

1. A correlation between the percentage of people with diseased teeth and the degree of civilization in a country has been pretty clearly shown. Dr. Röse cites the results of older

[1] Zeits. f. Schulgesundheitspflege, 1897, p. 630.
[2] Zeits. f. Schulgesundheitspflege, 1897, p. 292.
[3] Zeits. f. Schulgesundheitspflege, 1903, p. 105.
[4] Zeits. f. Schulgesundheitspflege, 1904, p. 885.
[5] Zeits. f. Schulgesundheitspflege, 1902, p. 253.
[6] *Ped. Sem.*, Vol. VIII, pp. 45-58.
[7] *Loc. cit.*, p. 47.
[8] Zeits. f. Schulgesundheitspflege, 1895, 6, p. 350.
[9] Intern. Kongress f. Schulhygiene, III, p. 498.

studies[1] to the effect that of Eskimos only 2.5% have defective teeth, of Indians, 3 to 10%; of Malays, 3 to 20%; of Chinese, 40%; while, as has been shown, 70 to 100% of Europeans and Americans are thus diseased. To determine the causes of this correlation is a more difficult matter. Perhaps, as many think, modern food is the special cause.

2. Although not yet clearly determined a correlation probably exists between the condition of the teeth and general environment. Dr. Röse says it is a wide-spread belief that country people and the poor have better teeth than those living in the cities and the well-to-do. This he did not find to be true. Of all the places where he made investigations, the worst condition of the teeth was found in the poor villages of the Black Forest. The number of children with defective teeth in four towns, for example, was from 98 to 99%, the number of defective teeth from 36% to 40%.

Some other investigators find apparently different results. Pedley studied the dental condition of 3,800 boys and girls, of ages from 3 to 16[2]. Of these 326 had sound teeth. The schools where his investigations were made were within 20 miles of London, on extensive grounds, where the inmates had all the advantages of good air and exercise. He thinks that caries occurs more frequently among the well-to-do classes. Thus in a high class public school, where the boys, however, were over 13 years of age, of 427 examined only 7 had sound and complete dentition, although many of the defective teeth had been filled.

Dr. Spokes has collected statistics during a period of nine years at one of the English Public Schools. Twelve hundred boys of a good social class were examined and the actual condition of each dentition carefully recorded. The average age was 13 years 10 months. As regards the permanent dentition only 3% had sound teeth, 18% had teeth rendered artificially sound by extraction or filling. The remaining 79% required treatment, and the percentage of diseased teeth rose from 2.19 at the age of 13 to 6.16 at 17 years of age.[3]

The British Dental Association has investigated the conditions of the teeth of children in the Poor Law Schools, Workhouses and Reformatories. Fourteen per cent. of these children had sound teeth.[4]

Whatever may be the truth as regards these conflicting results, and whether laboring people have better or poorer

[1] Zeits. f. Schulgesundheitspflege, 1895, No. 2.
[2] The Hygiene of the Mouth, Philadelphia. pp. 12-15.
[3] Spokes, Sidney: The care of the teeth during school life. International Kongress für Schulhygiene, Vol. III, p. 453.
[4] Spokes: *loc. cit.*, p. 454.

teeth than the well-to-do, and whether the country children or the city children are better off in this respect, anything that affects the general nutrition is likely to affect the teeth; and probably some special factors in the environment are important, for example, the richness of a given locality in lime.

3. An interesting correlation apparently exists between the percentage of sound teeth among the children in a community and the amount of lime in the soil. This was first shown in the extensive investigation by Dr. Röse of the teeth of school children in Baden and Thüringen.[1] In the regions deficient in lime 1.3%-2% had perfect teeth. In the regions rich in lime 17.2%-21%. The color of the teeth in Thüringen was also observed. In the districts rich in lime a brilliant yellow was the predominating color. In the regions deficient in lime, it was white yellow or blue gray. And the teeth were better formed in the former than in the latter regions. The total results were as follows:

In Baden.

	No. of children.	% with defective teeth.	% of defective teeth.
1. Freiburg,	3,460	98.7	35.
2. Localities deficient in lime,	747	98.7	35.3
3. Localities rich in lime,	911	79.	16.1

In Thüringen.

1. Localities deficient in lime,	2,973	98.	34.9
2. Localities rich in lime,	2,708	82.8	16.7

This correlation was corroborated by studies in Sweden which showed that the percentage of diseased teeth was inversely as the degree of hardness of the water. The results for several towns are shown in the following table.[2]

	Hardness of water.	% of children	% of diseased teeth.
Boras,	0.5	97.7	25.0
Karlskrona,	0.7	96.5	24.6
Stockholm,	3.5	96.9	24.2
Karlsham,	4.8	93.9	23.0
Skano,	8.5	92.1	17.7
Malmö	12.0	90.3	15.4

[1] *Loc. cit.*
[2] Zeits. f. Schulgesundheitspflege, 1898, p. 331.

In an investigation in Halle in 1902 the dental condition of 4,901 boys in the Peoples Schools was reported, and of these 95.2% had defective teeth and the average for each pupil was 6.6% diseased teeth. Here the character of the water was reported as moderately hard.[1]

4. As might be inferred, the percentage of children afflicted with caries as well as the percentage of decayed teeth is correlated with the age of the pupils. Supt. Johnson found that even at the age of four 29% of the teeth were diseased. This number increased to 41% at the age of nine; the greatest immunity was at eleven, when most of the temporary teeth had been replaced by the permanent teeth and only 21% were diseased; but the number increased again to 43% at fifteen.[2]

5. As regards a correlation between dental condition and mental ability it is noteworthy that in Magdeburg 4,522 children were investigated by a dentist and special attention given to the children in the schools for the backward. Among children of the latter schools caries was not found as frequently as among the other children. 5.95% had sound teeth as against 3.07% of the other children. Other diseases, however, were more frequent among these than among children in the regular schools.[3]

While feeble-minded children also, as indicated by the observations of Hrdlicka and Johnson, seem to compare favorably with normal children as regards the condition of their teeth, and while dull children often have good teeth, nevertheless a correlation between the dental condition and the success of the children in school work is indicated by Johnson's study. He reports:

'The children examined were classified by their teachers as bright, average, or dull. Among the children with good teeth there were found 13 bright children to every 10 dull children, but among the children with poor teeth were found only 8 bright children to 10 dull children. It was found, also, that very generally the average age of children with good teeth, in any grade, was less than that of children with poor teeth for the same grade. So far as these statistics go, they seem to indicate that the chances of children with good teeth are appreciably better for scholarship and promotion than are those of children with poor teeth.'

6. Several investigations indicate a correlation between the condition of the teeth and the physical development. Johnson reports that the children with good teeth in his schools were on an average about half a year ahead of the children

[1] Zeits. f. Schulgesundheitspflege, 1904, p. 333.
[2] *Loc. cit.*
[3] Zeits. f. Schulgesundheitspflege, Vol. XVI, 1903, p. 337.

with poor teeth in physical development as shown by weight.[1] Likewise studies of the dental condition of recruits in Dresden showed that those with bad teeth furnished a third less capable soldiers.[2]

Some investigators have found results that seem to indicate that the conditions of school life have an appreciable effect in causing the large per cent. of defective teeth among school children. Galippe observed that in the last years of school life, at the time of preparation for the rigid examinations, the number of cases of caries increased. Siterwood also found that in a few months after entering school the teeth change. And Magitot has also pointed out the dangers of continued study in its effect on the teeth. The effect, of course, may be increased by heredity and the like. But many authorities believe that depressed physical condition, overwork, cerebral hyperæmia, and possibly the use by the brain of phosphates needed by the teeth, are among the circumstances that cause this increase in disease. The fact remains that those pupils who overwork in preparation for examination and the like, are especially liable to this disease. And Johnson thinks that 'a very bright child may have very poor teeth, the bad condition of the teeth being, in a considerable measure, induced by over stimulation of the brain.'[3]

The close connection between disease of the teeth and other diseases is indicated by the studies that have been made. Of the various disorders frequently caused or aggravated by decaying teeth are not only enlarged glands of the neck, headache, neuralgia, earache, but indigestion, heart trouble, irritation of the nervous system, epilepsy, and perhaps chorea and other neuroses. Professor Miller, in a report to the Central Association of German Dentists in Berlin, says: "Mass studies of school children and soldiers have shown that frequently the general nutrition suffers on account of defective teeth."

Some of the concrete cases reported by Pedley are specially instructive. The following are examples.

"A married woman, æt. 36, had for two years suffered from excessive cardiac irregularity, and frequent attacks of spasmodic heart panic. She attributed her illness to much mental anxiety. Her symptoms had increased and the cardiac disturbance became so constant that she could neither go into society nor receive friends. There was no valvular disease of the heart, its dimensions were normal, but the action was irregular and intermittent. Her teeth were extensively decayed, surrounded with tartar, and the gums were unhealthy. The affec-

[1] *Loc. cit.*, p. 54.
[2] Zeits. f. Schulgesundheitspflege, 1895, p. 427.
[3] *Loc. cit.*, p. 53.

ted teeth were removed under gas and ether, 'which she took well,' and from that time all the heart symptoms entirely ceased."[1]

"A boy, aet. 13, has had frequent attacks of epilepsy for the last eighteen months. Latterly his mother has noticed that some days he rubs his left cheek, complaining of face-ache, after which the fit follows. On examining the mouth, there is to be seen a molar tooth considerably decayed, with a swollen gum around it, and partly growing into the cavity. It is not very tender to the touch, and the examination does not give rise to toothache. On questioning, I find the sensation which the boy experiences before a fit does not seem to be one of pain, but rather of an indefinite uneasiness. He always has a fit the night this comes on. Has never felt it during the day, it is always about seven or eight o'clock. I desired the mother to have the tooth extracted, and ordered a simple saline with a quarter of a grain of belladonna to be taken twice daily. This was in June. The tooth was extracted the next day. I saw this boy once a fortnight from that time for four months, but he has had no recurrence of the fit."[2]

Without laying stress on the investigations which suggest at least that the conditions of school life are in part responsible for the prevalence of caries, it is clear that the hygiene of the teeth is an important part of school hygiene. First, good teeth are necessary for good digestion. With many pupils suffering from indigestion and impaired nutrition, and with from 80 to 98% of them liable to have the toothache at any time, the conditions are not favorable for cheerfulness, enthusiasm, and good discipline. 22.5% of the children in Andover said they had suffered a great deal from toothache during the preceding year; half of the rest said they had suffered more or less. Second, poor teeth interfere with articulation and make instruction, especially in reading and singing, more difficult. Third, it is impossible to have pure air in a schoolroom where there are so many decaying teeth.

It is not necessary to consider in detail the causes of diseased teeth. They seem to be two combined: 1st, lack of nutrition—especially lime; 2d, micro-organisms resulting from lack of care of the teeth. Dr. Röse's investigations indicate the important influence of the former cause. Galippe and Vignal long ago made investigations that indicated the influence of the latter. Of course these two factors work together. The less perfectly the teeth are developed from lack of nutrition, the more likely they are to succumb to the bacteria. The

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[1] Pedley, R. D.: The Hygiene of the Mouth, pp. 85-86.
[2] Pedley: *loc cit.*, p. 24.

French investigators just mentioned, according to a report in 1889 to the Paris Biological Society,[1] studied the bacteria that had penetrated the dentine, and found six different kinds of micro-organisms, and three kinds in the pulp of the tooth. From the character of some of these their effect on the teeth is clear. Several of them form lactic acid, and this destroys the mineral substances of the teeth: and others that destroy albumen attack the organic matter.

Whatever the ultimate cause of decaying teeth, the presence of micro-organisms in the mouth is the immediate cause. When the debris of food is left between the teeth this forms a favorable medium for the bacteria, consequently the one essential prophylactic measure is absolute cleanliness.

As regards food, it is doubtless advisable that the coarser kinds of bread, hard rolls and the like, which require chewing, should be used. Thorough mastication is an advantage not only as an aid to digestion but directly for the benefit of the teeth. Excessive use of sweets is bad, and yet this is not nearly so bad, perhaps, as soft, starchy food. According to Miller[1] starchy and amylaceous substances are more detrimental to the teeth than sugar. Sugar is readily soluble and easily carried away, whereas amylaceous matter adheres to the teeth for a longer time. The starch is converted by the ferment of the saliva into sugar, and this sugar acted upon by the bacteria produces lactic acid. Pedley finds from his own experience among the poor in the hospital that this seems to be true, and he deems it a mistaken idea to deprive children of wholesome sweets in order to preserve their teeth.

It is specially important that the temporary teeth should be cared for. First, because they serve the purpose of mastication during a most important period of life; and second, because carious temporary teeth often spoil the permanent teeth. These teeth come half a year sooner with girls than with boys. The change also comes sooner with girls. These teeth may begin to decay as soon as they come. Little attention is usually given to them from the mistaken notion that it is unnecessary to preserve them. This is really a curious illustration of our general attitude toward children. Our idea of a child has been that of the philosopher Franklin, a child is an important creature because some day he will become a man. Hence we feed children that they may grow to manhood, we educate them that they may be prepared for manhood's duties, we sacrifice their baby teeth because they will not last till adult life anyway. The comfort and perfection of a child as a child we

[1] Zeits. f. Schulgesundheitspflege, 1889, pp. 602-604.

[1] The Micro-organisms of the Human Mouth, p. 207, quoted by Pedley, p. 8.

have neglected. The general attitude towards children's teeth is an interesting case in point. If they become painful they can be extracted. As to mere discomfort, the children will make all the better men and women from having learned to bear disagreeable things when young. These teeth, however, should be cared for and filled when they decay and extracted at the proper time. This not merely to preserve a child's comfort and the best condition of nutrition, but because normal temporary teeth are a condition of normal development of the permanent teeth.[1] It is a concrete case in the child's anatomy where normal immaturity is a condition of normal maturity.

Specially important is the care for the sixth year molar. This is one of the strongest and largest teeth in the head, and yet Mr. Johnson found that one in six of these teeth were diseased during the first year; and in Copenhagen it was found that one-third of the 6th year molars were decayed already in the 7th year.[2] It frequently happens that these teeth are lost before parents realize that any permanent teeth have come.

"Dr. Mary E. Gallup, of Boston, for several years gathered statistics of the 6th year molar in the mouths of native born Americans. Of 3,000 Americans over 25 years of age, only seven had all four sixth year molars in the mouth."[3]

Dr. Henie gives in the following table the percentage of these teeth diseased at different ages as found in his study of 660 school children in Hamar in Norway.

SIXTH-YEAR MOLARS.[4]

Among	7	years old	children	18.5%	teeth diseased.
"	8	"	"	40.9%	" "
"	9	"	"	50.3%	" "
"	10	"	"	52.8%	" "
"	11	"	"	49.3%	" "
"	12	"	"	53.3%	" "
"	13	"	"	55.5%	" "
"	14	"	"	57.5%	" "
"	15	"	"	60.3%	" "

The indifference to the necessity of caring for children's teeth in civilized communities would be amazing and incomprehensible unless we largely accept Lombroso's philosophy of laziness, that the law of inertia is the principle to which all human activity conforms. Sound teeth are essential to digestion, articulation, æsthetic satisfaction, and general comfort.

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[1] Johnson: *loc. cit.*, p. 49.
[2] Zeits. f. Schulgesundheitspflege, 1897, p. 630.
[3] Cited by Johnson: *loc. cit.*, p. 48-9.
[4] Zeits. f. Schulgesundheitspflege, 1898, Vol. II, p. 69.

Every permanent tooth saved is better for a child than a hundred dollars in the savings bank. And yet parents make slaves of themselves to save a few dollars for their children and have not time to teach them habits of common decency in regard to dental hygiene; and when the paltry savings have been accumulated for the rainy day, the gold of Ophir cannot make the lost molars grow again, and it is good fortune if artificial teeth save their children from disease and speech defects. This indifference of the community to the importance of caring for children's teeth is so general that special measures should be taken to overcome it.

In Germany some attempts to enforce dental hygiene have been made in the schools. In Russia, Gawronsky reports that in a number of Gymnasien for girls the value of special attention to the teeth and of special instruction has been shown. He advocates school dentists for the elementary schools and special instruction for dormitories. By decree of July 31, 1889, Von Gossler required of the pupils in higher schools that they clean their teeth daily after the evening meal. Hygienic rules have been formulated by others.[1] We cannot do as the Germans do. But more adequate instruction should be given. Habits of dental cleanliness should be developed until a child learns to regard a toothbrush as a necessity. A British officer who was with our army in Cuba has reported his astonishment at one thing that he observed among our regular soldiers. When the heat was so intense that the soldiers had thrown away blankets, clothing and the like—everything except the barest necessities,—company after company marched by, each soldier with a toothbrush twisted in his hat band. Such an attitute toward the toothbrush should be developed in the home and in the school.

Trouble from the parents has naturally been found when an effort has been made to enforce dental hygiene. When care of the teeth was required in the French Lycées, Magitot met great resistance. Parents are apt to be satisfied if there is no acute trouble; to take prophylactic care is not thought of,—this is a luxury for the upper ten thousand. It was said a few years ago that two-thirds of the dentists in Vienna were in the aristocratic quarter, only one-third in the other nine districts. Much the same is probably true of our own large cities. Good teeth are apt to be considered an ornament rather than tools.

Dr. J. Frank, President of the Dental Association of Vienna, maintains that caries of the teeth is a plague, and the focal point of action in the sanitation of this disease is in the school.

[1] Zeits. f. Schulgesundheitspflege, 1895, 10, 11, pp. 603-604.

Even at the entrance of school life, in the sixth year, every third child has diseased teeth.[1]

In the last few years a noteworthy movement to meet this evil by establishing dental clinics in the schools has begun. School dentists have been in service for several years in St. Petersburg, Leipzig, Hamburg, and a number of other European cities. In Hamburg the work was begun privately. A large number of dentists gave part of their time for the care of the pupils' teeth in the schools. At a definite hour each week school children suffering with diseases of the teeth could be sent for treatment by the principals of the schools. One serious difficulty was met, however. The hours of the dentists were between nine and four, and the school board objected to having the children consult the dentist during school hours, not considering, apparently, that a child with the toothache does not learn much in school. In Altona it is reported, a similar plan has been carried on without injury to instruction.[2]

In Darmstadt the Association of Hessian Dentists, in 1902, opened a clinic for the treatment of school children with defective teeth. This work was supported by the contribution of a private individual but carried on with the co-operation of the city officials.

In Strassburg a school clinic supported by the city, said to be the first in Germany, was opened in the year 1902-3.[3] The need of dental inspection in the schools, the methods, and the results are shown by the work in this city. Dr. Jessen, the Director of the Clinic, gives the following report for the year 1904-5.[4] The number of children inspected was 4,372,—2,269 between 3 and 6 years of age, 2,103 between 6 and 8. Of the younger children only 15.95%, of the older only 7.02% had healthy dentition. The younger children had a total of 9,427 diseased teeth; of these 1,655 in gangrenous condition. The older children had a total of 11,701 diseased teeth; of these 3,392 gangrenous. About a third of those treated had visited the clinic on account of toothache. The investigation and treatment were so arranged that the instruction was disturbed very little. Special blanks were prepared, and thus it was possible to examine on an average 80 children in an hour. The School Inspector, Herr Motz, maintained that the total number of school hours spent in the examination of the teeth and treatment was less than the total absence from school formerly on account of the toothache and other results of diseased teeth.

[1] Zeits. f. Schulgesundheitspflege, 1903, Vol. XVI, p. 180.
[2] Zeits. f. Schulgesundheitspflege, 1903, Vol. XVI, pp. 306, 327.
[3] Zeits. f. Schulgesundheitspflege, 1903, Vol. XVI, pp. 423, 645.
[4] Vierteljahrschrift f. Körp. Erziehung, I, 4, pp. 177-186.

The cost of the dental inspection and treatment for the year was only about $1,600 (6,400 Marks).

It is true that certain criticisms have been made of investigation of the teeth in the schools on the ground of loss of time, the danger of infection in these mass investigations, objections made by parents, etc.; but experience shows it is a legitimate and necessary part of health inspection.

The important points emphasized by these studies of the teeth of school children and adults may be résuméd very briefly.

1. Caries of the teeth seems to be a disease of civilization. At least observation and the somewhat meagre studies already made indicate that the disease is rare among primitive peoples.

2. It appears that usually from 80% to 100% of school children have diseased teeth. The estimate of the International Dental Congress referred to above is a conservative one, although where dental inspection has been introduced, and in some remote country districts, like parts of Siberia, there may be a smaller percentage.

3. A direct relation between the number of defective teeth and the amount of lime in a region seems to have been established by the investigations of Röse and others.

4. Among the causes of defective teeth the following seem to have been demonstrated: lack of nutrition, use of soft, starchy foods, use of sweets, as well as the lack of lime in the water, already noted. The immediate cause, however, is the presence of micro-organisms in the mouth.

5. The results of defective teeth have been emphatically shown by the investigations and reports of dentists. Neuralgia, headache, earache, indigestion, cardiac disturbances, enlarged glands of the neck, sub-acute blood poisoning, and various nervous disorders, including some cases of epilepsy, and perhaps also of chorea, are among the diseases caused or specially aggravated by decaying teeth. In looking for the cause of these various disorders, examination of the teeth by parents and even physicians is strangely neglected.

6. As regards hygiene, first it should be noted that care of the temporary teeth is of special importance. These temporary teeth should be cared for first because of their importance for the child's nutrition at the time, and second because caries of the temporary teeth often injures the permanent teeth. These should be kept in good condition as far as possible; and with general hygiene and proper care of these teeth the young child will probably seldom suffer from disease of any kind.

7. The sixth-year molars are very apt to be lost soon after they appear. Hence the need of special care for them.

8. The whole hygiene of the teeth resolves itself into a mat-

ter of cleanliness. The study of bacteriology has put the whole subject of cleanliness on a scientific basis, and it shows that cleanliness of the mouth is an important factor of hygiene. Pupils should be trained to habits of cleanliness in this respect, to know the luxury of a clean mouth. Then they will take care of their teeth.

9. As it cannot be hoped that sufficient care will be taken to prevent decay of the teeth altogether, and as instruction both of pupils and parents is needed, it is imperative that school dentists should be appointed to examine the teeth of children periodically. Dental inspection is an essential part of health inspection.

10. In general the importance of this whole matter of the hygiene of teeth for school hygiene is obvious. It is impossible to have pure air if 95% of the children suffer from caries. It is almost impossible to have good discipline with a large number suffering from toothache or the reflex effects of diseased teeth, and it is not easy to get the most efficient school work without a better condition of nervous and general health than is possible with so large a number of defective teeth.

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GENIUS AND STUPIDITY.

A Study of some of the Intellectual Processes of Seven "Bright" and Seven "Stupid" Boys.

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I. Introduction: Psychology and Life.

One of the most serious problems confronting psychology is that of connecting itself with life. The wholly modern development of psychiatry and criminology, the recent activities in individual psychology, a continuous tempest of articles, pamphlets, and books on the relations of psychology to education, all point to the fundamental importance of the task.

This problem offers itself not to psychology alone but to all the sciences, and it may be said that they have excuse for existence only to the extent to which they are capable of framing a solution. Humanity has a vested right to demand of the scientist now and then that he show his hand. Theory that does not some way affect life has no value. Morever, as President William Lowe Bryan has pointed out, (3) such theory is *ipso facto* not true. That it seems so is due to the "illusion of precision," in the interest of which we shut out from consideration all of reality except the portion immediately before us. Why wonder, then, that that atom has no connection with the manifold from which we took it?

It hardly need be said that other sciences have bridged this chasm more successfully than psychology. In the words of Spearman, "When we pass an electric current through water

until it vaporizes into bubbles of hydrogen and oxygen, we can be tolerably certain that we have still got in our jars almost the whole of the same material substance, only reduced to simple form. But when we assert that the decision of Regulus to vote against making peace with Carthage was no more than a conglomeration of visual, auditory and tactual sensations in various stages of intensity and association, then there is an undeniable risk that some precious psychical elements may have slipped through our fingers." (18, p. 204.)

On the other hand, John Stuart Mill held that the common opinion that the thought, sentiments, and actions of human beings cannot be the object of science, rests upon the confounding of all science with exact science. Mill conceived an intermediate between the perfection of science and its extreme imperfection. For example, a phenomenon may result from two sorts of causes; from major causes accessible to observation and calculation, and from minor, secondary causes not thus accessible. In such a case we shall be able to account for the principal part of the phenomenon, but there will be variations and modifications which we cannot completely explain. Mill compares the science of human nature with the science of the tides, which can never become exact in the strict sense, and yet is exact enough to be practically useful. The exactness is not like that of present astronomy, but more comparable to the condition of astronomy when its calculations included only the principal facts and not the perturbations. Ribot, speaking of Mill's proposed science of *Ethology*, says: "No doubt this science will always partake considerably of the nature of art; will it not be sufficiently exact, however, to render its employment legitimate? The naturalists have discovered certain organic correlations on which they rely for the reconstruction of an animal from a few fragments. Might not the psychological conditions be equally arrived at? Let us suppose that by an accumulation of sure and varied experiments we were enabled to establish, for instance, that a certain manner of feeling supposes a certain variety of imagination, which in its turn supposes a certain mode of judgment and reasoning, which again supposes a certain method of acting; and let us suppose that this determination should be as precise as possible. Then by the aid of a few facts it might be possible to reconstruct a character, since the problem would reduce itself to the following: Given a member of the series to find the entire series."

The sciences, as Comte observed, were historically produced in the order of decreasing generality. We need, therefore, no greater proof of the lingering of psychology in its infancy than the striking fact that little application has proceeded from it.

Thus it was for centuries with physics and chemistry, thus also with the biological sciences, whose results are yet only dimly foreseen. The difference among the sciences in this respect lies partly in the subject matter; whether it is living or inert. But the difficulty is not thus wholly accounted for. The biologist is not nearly so badly off as the psychologist. He knows a particular plant or animal organism better than any ordinary individual does, while on the other hand it has passed into proverb that of all men the psychologist is the most helpless before the individual mind. If taken to task, he pleads the doubtful excuse that it is his business to know mind in general and that he has nothing to do with this or that individual mind. Can we wonder that the mathematician, physicist, or even the biologist, who, like the psychologist, deals with life, should smile occasionally at the artificial constructions of psychology?

One thing seems certain; viz., that psychology and life cannot be connected until we have transcended the psychology of structure. To that end psychology will need to follow in the path of biology, which is becoming increasingly dynamic. From this point of view, the *structure* of the animal or plant does not concern us except as it shapes the force of the organism as a dynamic agency. It is thus that the chasm between the old morphology and life is being spanned. If psychology would seriously enlarge its *raison d'être* it must follow this example.

On the other hand, it is asserted, as by Professor Titchener (22), that whatever may be in store for a future functional psychology, the present demand is more pressing for the study of structural elements. It is true that always in the history of science, the static and structural aspects receive attention first, just as in biology anatomy developed before physiology. But in psychology there is already a tendency in the opposite direction. We are beginning to realize that the hypostasized segment of consciousness known as sensation is not the ultimate and true reality. In psychology, function, in part at least, produces structure. We cannot truly know what consciousness is, till we know what it does. Professor James has succeeded in giving meaning to our conscious states without breaking them up into fragments. "On the whole," he says (8), "I venture still to think that we really gain a more living understanding of the mind by keeping our attention as long as possible upon our entire conscious states as they are concretely given to us, than by a post mortem study of their comminuted 'elements.' This last is the study of artificial abstractions, not of natural things." This conception, if logically carried out, can only end by extending the field of psychology to include

logic, ethics, and æsthetics. Logic becomes the applied psychology of reasoning, ethics the psychology of motives and impulses, and æsthetics a chapter in the psychology of the emotions.

The earliest attempt, at least in modern times, at a direct relating of psychology and life, was phrenology. This, science at once disowned. More recently the French have made, on little larger empirical basis, elaborate classifications of types of character. Over against these we have the empirical work coming under the head of *mental tests*. This latter work is of two sorts: one embracing a small amount of data from each of a vast number of individuals, and the other made up of intensive studies of a very few subjects. A large number of such intensive studies would seem to offer a better basis than can be gained in any other way for a psychology of character or temperament, or for any scientific classifications from the psychological point of view.

But at the outset it may be objected that the differentiæ which mark off types of mentality from each other are not proper subject matter for psychology, that they touch us only on the practical side, and that if we would seek justice to the great synthesis of reality we must look to art. In freely awarding this function to art, as is obviously its due, we do not thereby invalidate the claims of individual psychology. All individual differences of fundamental importance are subject matter for general psychology. Comparative psychology deals with the largest of these differences. Age and sex differences already receive careful attention from most workers. It is only the minor differences—those unessential to science—that psychology is willing to surrender to the domain of art. The contention here made is that over and above these minor differences there are deep and fundamental lines of cleavage among individual mentalities the existence of which is as yet hardly suspected; that in dealing with individual minds we encounter no smaller differences than the zoölogist finds in his own field.

But we have only to compare the relative status of the zoölogist and psychologist to see how the latter has lagged behind. While the zoölogist has no longer any difficulty in stating the essential differences between even such superficially similar animals as the whale and the fish, psychologists cannot agree on the features distinguishing the most widely separated grades of intelligence. And yet there is certainly as much variety in psychical types as in the physical. One important difference is that the psychologist has to deal with facts more hidden from direct observation. The differences, however, when found, are certainly as great in one case as in the other.

This advocacy of a scientific classification does not mean to cast discredit upon the practical classifications that grow out of every-day experience. Far from discrediting classifications that have been found serviceable, the kind of work here advocated, would simply follow the example of Linnæus in seeking for more fundamental bases of division.

Such study, moreover, cannot fail to be rich in pedagogical suggestions. Just as the laboratory study of comparative psychology has justified itself both by its suggestiveness for general psychology and for education, as well as from the standpoint of evolutionary theory, so should experimental results gradually replace the "interesting stories" about children. Along the line of mental tests, a few psychologists entertain serious expectations of immediate practical results. Binet, for example, in 1896 expressed the hope that he would soon succeed in devising a series of mental and motor tests which would be so simple that even the ordinary parent could apply them to his child and in an hour or two reach results which would indicate definitely the child's grade of intelligence. Others have recommended such tests as helps for the physician. Simon (17) states, regarding the method of the "copy," "convenient, short, and exact, this copying of phrases constitutes a good method of diagnosing a child's intellectual development at the very moment of the experiment. Kirkpatrick (10) thinks his tests should be of some value to the school superintendent or teacher in settling doubtful cases of promotion. Bolton (2), speaking of the unsatisfactoriness of the ordinary school examination and of the need of replacing it by something more scientific, suggests that "Tests of physical endowment and of general healthiness of body seem to offer the most promise of finding what is wanted." It is implied, also, that in other walks of life such tests will come in to determine fitness to do various kinds of work. Galton long ago remarked that "One of the most important objects of measurement . . . is to obtain a general knowledge of the capacities of a man by sinking shafts, as it were, at a few critical points." Near the close of one of the most important contributions yet made to the subject, namely, that by Spearman (18, p. 277), we have the following statement: "Here would seem to be the long wanted general rational basis for public examinations. Instead of continuing ineffectively to protest that high marks in Greek Syntax are no test as to the capacity of men to command troops or to administer provinces, we shall at last actually determine the precise accuracy of the various means of measuring General Intelligence, and then we shall in an equally positive manner ascertain the exact relative importance of this General Intelligence as compared with the other characteris-

tics desirable for the particular post which the candidate is to assume. Thus it is hoped we shall eventually reach our pedagogical conclusions, not by easy subjective theories, nor by the insignificant range of personal experience, nor yet by some catchpenny exceptional cases, but rather by an adequately representative array of established facts."

It must be admitted that expectations along the line of the above suggestions are little justified by the results already obtained by such tests. The requirements of the psychological laboratory can no more be simplified so as to be met by the ordinary parent or teacher than can those of the physical or biological laboratory. In the light of present conditions, the suggestion recently made by Cattell (4) seems much more reasonable; namely, that there is destined to grow up eventually a large body of psychological experts who will play a rôle in the future as important as that of the medical men at present. The wide and varied usefulness of such a body, supposing them to exist and to be adequately equipped, need not be insisted upon. Psychology can, however, do more harm than good in the educational field and in its other fields of possible usefulness if its results are prematurely applied.

We need not argue the point further. The following study, at least, is undertaken in the faith that psychology and life are not prime to each other, and that even at present some of the common factors may be sought without thereby cheapening either the methods or results of experimental psychology. How extremely little is herein contributed to this end, no one is better aware of than the writer; but he would fain co-operate with the pioneers already at work, and ventures to offer the following account of his experiments for what it may contribute to the choice and evaluation of methods in this comparatively new field.

II. Nature, Purpose, and Conditions of the Study.

Studies with mental tests readily fall into two chief classes. On the one hand, (A) are the more or less superficial tests of a large number of individuals. These again are of two sorts: (1) Those which, in sets perhaps of ten to twenty tests, hope to mark off in the space of an hour or two the chief facts in one's whole mental individuality. These are usually made, as has been said, with a large number of subjects and therefore are liable to be hurriedly and roughly executed, and often with the help of half-trained assistants. (2) Such work as that of Spearman, already referred to, which also uses a large number of subjects, but instead of trying to mark off the entire personality aims at testing one or a few traits under very carefully controlled conditions. But all tests of the A group aim at exact

quantitative results. They are psychophysical. They must be so planned that they will not allow of several different types of reaction, but so that the results shall present only units of *quantitative* difference. The aim is mathematical correlation, and the individual subject has no place in the interpretation of results.

There is another approach, (B) quite different from the above, aiming more at a *qualitative* analysis of the processes involved. Examples are the work of Kraepelin and his students in Germany, Binet in France, and Sharp and Kuhlmann in America. This method prefers a few subjects carefully studied. It aims to characterize the mental differences among them, hoping in the end to throw light on ultimate problems of psychological analysis. Instead of applying tests which yield an unequivocal *yes* or *no*, or *so much* or *so little*, it may even put problems which allow of widely different attempts at solution, of a number of possible kinds of errors, and of different methods of correcting these errors. General observation is appealed to, and in all respects such work may utilize rougher data than would be possible in purely quantitative studies.

The study to be reported is distinctly of the latter type. It makes no attempt at psychophysical exactness and the establishment of mathematical correlations. The ideal followed is shaped largely by such work as that of Hobhouse on animals and that of Binet in his "Experimental Study of Intelligence."

The fact that the study aims chiefly at intellectual to the neglect of emotional and volitional differences must not be construed as antagonistic to the voluntaristic trend of modern psychology. On the contrary, I believe that the key to an explanation of the intellectual differences I have found lies often in native differences of emotional reaction. The difficulty of the task and the lack of time have kept me to the narrower field.

What value can such a study have for psychological theory? In the first place it should throw some light on the problem of "general mental ability." Is intellectual ability (to adapt the figure of Lloyd Morgan to our purpose) a bank account, on which we can draw for any desired purpose, or is it rather a bundle of separate drafts, each drawn for a specific purpose and inconvertible? Let us review a few of the highly contradictory answers that have been given it.

Ebbinghaus says (5): "Wherever we look we find that mental ability (*Tüchtigkeit*) consists in something similar; only the material changes with which it works. It is the same with the learned man who is able to fill the gaps and explain the contradictions of historical material, as with the artist who elaborates our sense perception through a meaningful conception of the whole, or as with the skilled merchant who makes disposition of his goods in accordance with his means, the needs of the public, and political and social factors." Spearman (18, p. 284), after stating the approximately absolute correspondence which he finds between "General Discrimination" and "Gen-

eral Intelligence," says: "The above and other analogous observed facts indicate *that all branches of intellectual activity have in common one fundamental function (or group of functions), whereas the remaining or specific elements of the activity seem in every case to be wholly different from that in all the others.*" Again he says: "As an important practical consequence of this universal unity of the intellectual function, the various actual forms of mental activity constitute a stably interconnected Hierarchy according to their different degrees of intellective saturation."

Perhaps the most outspoken advocate of the opposite view is Thorndike (21) Basing his conclusions on the lack of correlation found between simple tests of the ability to do two or more apparently similar things, he says: "Good reasoning power is but a general name for a host of particular capacities, the general average of which seems to the namer to be above the general average in other individuals." Again, "the most hopeless scholar in one field will in another be not so very far below mediocrity. The discovery of the exact amount of the relationship thus disposes finally of the opinion that brightness is brightness and that those who possess it may use it equally well in any field."

In the last quotation, the controversy takes on the aspect of a dispute between nominalism and realism. To deny General Intelligence on the ground that it is made up of a host of particular abilities whose relative proportions vary from man to man, is like denying the existence of a distinctively human body on the ground that the relative proportions of its parts are not the same for any two individuals. The important question is one of fact and not of name. If an individual takes low rank in every mental performance it is immaterial whether we say his "General Intelligence" is low, or whether we say he is defective in this, that, and the other "particular ability." And there are undoubted cases of individuals who take such universally low rank. As a contribution of fact, then, our study should have some bearing on the question of General Intelligence.

Again, it seems that a comparative study of intellectual differences should throw some light on the relative importance, for intelligence, of such factors as memory, habit, attention, etc., each of which, more or less, is teased out and thrown into relief by the conditions of the study. Nearly every sort of mental operation has been at some time or other singled out by psychologists and set up as the leading element of intellectual ability.

My subjects were specially selected as among the brightest or most stupid that could be found in the public schools within easy distance of Clark University, in the city of Worcester. Three ward principals, by the aid of their teachers, made out a list of about two dozen boys of the desired age, equally divided between the two groups.[1]

These two dozen were selected from about 500 boys. Out of this list, fourteen were found who were willing to come to the University as often as desired for experimentation—seven bright and seven dull. They came singly, or sometimes in

[1] I am very greatly indebted to the principals and to the teachers as well, for their generous co-operation and particularly for the large amount of information they have given me concerning the school activities of my subjects.

pairs (according to the nature of the work), three or four times a week for one hour's work. To be more sure of regular attendance, they were promised a small fee for each visit, to be paid only in case they continued through all the exercises. This, however, would probably not have been necessary, as the confidence of the subjects was easily won, and the exercises were for the most part interesting and also quite out of the routine of their every day school-work. With a few exceptions, mentioned here and there in the results, the subjects gave every evidence of doing the best work they were capable of. Over much of it they were enthusiastic. Several of the subjects showed a good deal of interest and curiosity to know what ones were making the best records, and I had to be careful not to allow information to leak out that would discourage the poorer workers. By generously distributing praise, it was so managed that those whose work was almost uniformly poor never became aware of the fact.

All the work was done in the psychological laboratory of Clark University, except that with *M* and *N*, who spent about two hours at my home three to four evenings out of every week. In conversation and games, other than the tasks given, I had ample opportunity to get well acquainted with all. The trips made to the laboratory were at the following hours: 8 to 9. A. M.; 1 to 2 and 4 to 6 P. M. Altogether, I spent on an average about six hours per day, six days in the week, in personal contact with my subjects, singly or in pairs. This was begun about January 20th, 1905, and continued without intermission until May 10th following.

In making the selection of subjects, the teachers were asked simply for those they considered "brightest" or "dullest," in the ordinary significance of the terms. The only caution given was that their judgment should be based upon the child as a whole, and not simply upon his class work in the school subjects. In doing this it was not expected that the teacher's judgment would be infallible, but it was confidently expected that this method would afford two groups of subjects sufficiently distinct from each other for the purpose of a comparative study of intelligence. In this I was not disappointed. This procedure, however, has been criticised on the ground that the dullard at school often later shows himself efficient in life's activities. Such examples as Sir Walter Scott, Oliver Goldsmith, Patrick Henry, Wellington and General Grant have been frequently cited in support of this. No one would defend the school as a universally efficient test of mental ability, and yet the boy who with best effort cannot solve the school problems, who cannot master an ordinary vocabulary in his mother tongue or apply the simple rules of grammar, who sees no

meaning to historical or scientific facts after honestly trying to comprehend them, is not likely to be distinguished later as a man of intelligence. In some cases, closer investigation shows that the poor school standing imputed to many famous men has been exaggerated or partially reported. And, finally, what the present paper is concerned with is the testing of boys now considered bright or dull, without reference to their future development.

In the beginning, then, we do not define "brightness" or "dullness" any more definitely than does the world in general. The aim was to secure subjects whom most people would readily agree in classifying one way or the other, and then proceed to the investigation of what constitutes the fundamental intellectual differences between the two groups. A large number of such studies ought to end by giving us a definition of terms. At present, such definitions are lacking.

A more specific criticism might be made on the ground that a good deal of my work was carried on at an unfavorable part of the day, particularly that between four and six in the afternoon, after the close of the school day. That this may have affected the results to a certain extent cannot be denied, but that it did so to any considerable extent is unlikely. First, because the afternoon session in the Worcester schools is less than two hours in length; second, because my experiments were for the most part interesting to the subjects and quite different from the routine of school work; and third, most important of all, because past experiments indicate that a short, interesting, mental task, given to pupils who are undoubtedly fatigued after a day of school work, does not give serious indication of the presence of such fatigue. Moreover, the afternoon subjects were equally divided between the two groups in order that the relative standing of the groups might not be affected. In passing, it may be noted that my best subject did his work between 4 and 5 P. M.

Perhaps the most unfavorable element in the conditions of the experiment is the age difference. The ages of the subjects when the work was begun were as follows:

BRIGHT GROUP (I).

A	B	C	D	E	F	G
10 yrs. 2 mos.	11 yrs. 1 mo.	10 yrs. 10 mos.	10 yrs. 5 mos.	10 yrs. 8 mos.	10 yrs. 7 mos.	11 yrs. 5 mos.

DULL GROUP (II).

H	I	J	K	L	M	N
13 yrs. 5 mos.	10 yrs. 4 mos.	10 yrs. 9 mos.	10 yrs. 11 mos.	12 yrs. 5 mos.	11 yrs.	13 yrs. 9 mos.

It is practically certain that our results are not exactly what they would have been if there had been no age discrepancy. It should be noted, however, that excepting *N*, *H*, and *L* the greatest age difference is fifteen months. And if we also except *G* and *A*, the greatest difference is only nine months. *B*, *C*, *E*, *F*, *J*, *K* and *M* are within six months of each other. It must also be noted that the largest age differences are so distributed as to give the advantage in maturity to the dull group. Such intellectual distinctions between the groups as do appear will therefore be more significant than they would have been if the age advantage had been on the other side; and somewhat more significant than if there had been no age difference at all.

It need only be stated at this point that the home life and general experience of the subjects present no very marked extremes. None were from extremely poor families or gave evidence of lack of nutritious food. They were all from respectable, middle-class homes, though of course showing different degrees of culture and refinement, to be noted in the general observations. (Section XI, below.) All the subjects live in one of the best portions of the city which, as a whole, is uncrowded, clean and generally devoid of squalor. They have had as nearly the same sort of school training as one could expect from pupils of a given district of a given city. I think it may be stated that in general the environmental conditions have been favorable to the study.

The ability of the fourteen boys above described was subjected to tests at eight more or less different points, to wit: (1) their powers of invention and creative imagination; (2) their logical processes; (3) their mathematical ability; (4) their mastery of language; (5) their insight, as shown in the interpretation of fables; (6) their ease of acquisition, as shown in learning to play chess; (7) their powers of memory; and (8) their motor ability both in general and in the acquisition of bodily skill. The tests upon each point were numerous and varied but constituted a connected group. The details with regard to the particular tests of each group and the results obtained will be found in the eight sections next following.

III. INVENTIVENESS AND CREATIVE IMAGINATION.

Before taking up the experiments concerned with these

processes let us consider for a moment their general scope and nature.

What do we mean by invention? Otis T. Mason defines it as "every change in human activity made designedly and systematically" (14). According to this broad definition, invention is the typical intellectual activity, being involved in the creation of language, in art, social activities, and philosophy. We have only to compare the negro with the Eskimo or Indian, and the Australian native with the Anglo-Saxon, to be struck by an apparent kinship between general intellectual and inventive ability. Mason calls the great inventor an "epitome of the genius of the world." Bain also (1, p. 337) points out that the great inventors are men of scientific calibre and that the greatest of experimentalists are inventors. Paulhan (16) goes so far as to say that the inventions of the poet and artist do not differ at bottom from those of the scientist and philosopher. Mach (13, p. 174) quotes approvingly a saying of Liebig to the same effect, and adds that "if it is the business of the artist to build up his work from a few motives, it is the task of science to discover the motives which permeate reality." Likewise Mach asserts that the mechanical engineer is exercising much the same activities as the scientist, except that the riddles of the latter have more unknown terms and are less definitely put. According to this view, to develop a dog from a wolf, a Krag-Jorgeson from a bow and arrow, a lucifer match from the primitive fire stick, has involved much the same activities as have been operative in transforming fetichism and magic into religion and philosophy, or scattered knowledge into science. This theory derives a certain plausibility from the fact that mechanical inventions have grown up *pari passu* with the development of such great concepts as cause, number, time, space, etc. They have kept pace roughly, also, with the development of the arts, philosophy, science and religion. Such a parallelism in development is most easily explained by supposing the two phenomena dependent to a certain degree upon the same sort of mental processes, though doubtless many other factors are involved.

However this may be, it is clear that invention is largely dependent upon constructive imagination, the ability to abstract from present experience and picture new situations, their possibilities and their consequences. In both, images are united intentionally in order to form a new combination. It is imagination which invents. Reason is only a mode of control and justification. It determines values, accepts or rejects, but must get its raw material from creative imagination. Conjecture, which is only another name for the same thing, is at the basis of the most diverse scientific inventions. All sciences

begin with hypotheses. All this means also the ability to profit by experience, to sift out the useful element from a manifold, to bring the past to bear upon the future, to join elements previously isolated.

It is reasonable to suppose that the decisive intellectu al differences among men are not greatly dependent upon native retentiveness or mere sense discrimination. Far more important than this mass of raw sense data is the correct shooting together of the sense elements in memory and imagination. This is invention. It is the synthetic or apperceptive activity that gives the "seven-league boots" to genius. It is a kind of ability that all great minds exhibit. Why so great spontaneous relating activity in one mind and so little in another, is the ultimate problem in this portion of individual psychology.

The opposite of invention is not imitation, but routine. The absence of routine implies often a certain disequilibrium, a mental activity irregular and perhaps uncoördinated. It is a breaking up of preferred associations. We may think of it as due to a nervous ferment, for it is in point of fact augmented by certain maladies, as phthisis and alcoholism. (16, p. 167.)

We have above presented the view that at bottom all invention is one and the same thing. We are able, nevertheless, to mark out three sorts of inventive genius that differ somewhat from each other. They are, first, *mechanical* invention, involving a type of creative imagination that is exact, clear, objective, concrete, with little of the affective element. Second, *artistic* invention which is more emotional, subjective and romantic. Its imagery is somewhat less perceptual or concrete than that of mechanical invention, and it is more characteristic of dreamy and myth-making minds. Third, *scientific* and *philosophical* invention, whose imaginative constructions are conceptual, schematic, abstract. This corresponds to Ribot's three-fold division of the creative imagination.

It is probable that these three sorts of invention look more alike from without than from within. That is to say, while much alike if viewed objectively, they have each a peculiar affective tone that will make success in one a hindrance to success in another. It is partly interest that makes one revel in one kind and apathetic toward another. In embryo they show more similarities, but diverge rapidly as tastes and interests become set.

In the tests about to be described ten problems or puzzles were given. In some, the puzzle aspect was largely removed by the statement of the problem or by a hint given in such a way as to help the subject over the portion that might otherwise be thought to render the problem a "catch." The purpose of these problems was two-fold. In the first place, it was

expected that they would throw light on the differences in constructive imagination and the entire complex of activities that generally go under the name of invention. In the second place it was hoped they would reveal any differences that existed in the stage of development of the logical processes among the subjects. It was expected that such differences would show themselves in the methods of solution, the lower grade subjects adopting more the "method of trial and error" and giving more evidence generally of perceptual thought as opposed to conceptual. The last three are especially adapted to this end.

It may be objected that such problems as we have described below do not test real intellectual ability, but only a spurious kind which would better be denominated ingenuity, Yankee shrewdness, the *entrepreneur* spirit, or the ability which enables one "*se tirer d'affaire*." Without defending the thesis that such mental traits as are here called into play are faithfully indicative of mental ability in general, we may yet hold that they are so to a certain extent. Such, in the opinion of a recent writer, are the very qualities most necessary for the scientific research student. In the words of Professor Henry Shaler Williams (23), "The underlying principle of scientific research is simple inquisitiveness; that trait so characteristic of the Yankee and the fox. I use the term Yankee as the name for the smart, shrewd, inventive man, who depends upon his own resources, and if without learning or education, still succeeds in penetrating untried fields and in making headway under all manner of reverses, hindrances and difficulties, always exhibiting a quickness to observe differences and to interpret the meaning of things. All kinds of successful pioneers are made of such stuff." This trait of adaptability to environment would seem to constitute an important distinction between the higher and lower races. The Papuan is indigenous, the European is cosmopolitan.

All this, again, is in close harmony with Janet's recently expressed theory of brain levels. The three levels of Hughlings Jackson are replaced in this theory by five levels, the highest of which is not that concerned with conceptual and abstract thought, but the one that controls adjustment to immediate environment. With this highest level defective, one may be ever so learned and yet lack the chief elements that go to make up what the world regards as common sense. If the problems here presented appear trivial, it is due to our conventional modes of thought. In order to heighten our respect for even the slightest inventive genius we have only to glance at the slow and laborious processes in the development of all inventions. Engrossed in routine thinking for so long, most of us have lost our appreciation for naïve bits of originality. The book learning of the average educated man gives to his thought a routine and conventional setting that causes him to lose perspective. Such a person, struggling for university degrees and trying to master the current concepts of philosophy or science, begins after a while to fancy that his own sort of mental activity is of higher quality than the mechanic or artisan is engaged in.

Below is a statement of the first six problems, together with a description of the conditions and results for each. The other four will be considered in the following section on the Logical Processes.

Problem 1. A man has five short chains of three links each.

Show how he can put these five pieces together into one long chain by the use of only three weldings.

Conditions. The five pieces, made of small wire, were laid on the table side by side in front of the subjects. Care was taken to see that they understood what was wanted, after which they were asked to put the chains together. The problem offers two convenient places for assistance in case of failure. If the subject failed to discover within ten minutes that three links of one piece must be used as connecting links (as is necessary), then I opened such links and placed them before him near the other pieces. In most cases this hint was sufficient. When it was not, further help was given by placing the three open links in the proper positions.

Results. As given at first the problem may not be thought fair. The first point is really difficult to see. Only *D* and *L* were successful without any help, *D* within 30 seconds and *L* at the end of 4½ minutes. All the others, therefore, were assisted by my opening the three proper links. Thereupon *B*, *C*, *E*, *G* and *N* proceeded at once, within 30 seconds, to unite the other four pieces by means of them. *H*, *J*, and *K* also succeeded but only after further trials and errors, using 4, 2¼, and 4¾ minutes respectively. For *A*, *M*, and *I* the three links were not only opened but also placed in their proper positions between the pieces. Even then *A* and *I* did not get the idea, but continued fastening the links apparently without choice. Both failed in the 30 minutes allotted.

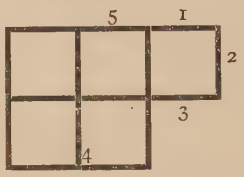
Of group II only *L* and *J* showed any noticeable tendency to study out the situation without actually placing and fastening the chains, while all the better group except *A* did so. In general, the attempts of group II were more rapidly made and the successive variations more trivial than those of group I. For example, if the first procedure was by fastening piece one to piece two and then to piece three, etc., the next attempt was likely to be by fastening one to five. That is, the essential point in the error was not grasped. Some in group I also started out in some cases with little more rationality, but with the exception of *A* they did not repeat an error so often in the same or slightly different form as did the boys in group II.

Problem 2. Fifteen matches were placed on the table so as to form the figure shown on the next page:[1] The subjects were asked to remove three matches and leave exactly three squares.

This test gives room for a certain amount of rational procedure. It is decidedly more rational to cast the eyes about to see what squares should be retained than simply to pick up

[1] Used by Miss Thompson: Mental Traits of Sex. Chicago, 1903. p. 111.

three matches at random and then look to see whether three squares are left. Casual inspection will show that certain of



the matches, *e. g.*, 1, 2, 3, 4, etc., must remain. The eye must run over the figure rapidly to see what portions offer the most promise. Rapid combinations of different squares must be made. Certain matches must be thought out of existence.

Results. No one of group II succeeded in the 10 minutes allotted. *E*, *B*, and *G* of group I were successful in 3½, 2 and 5¼ minutes respectively. The other subjects were assisted at the end of 10 minutes by having match 5 removed for them. *M*, *L*, and *N* finished in 2, 2¼ and 3 minutes respectively. The other four stupid subjects *H*, *I*, *J*, *K*, failed in the additional 5 minutes given. Of the remaining bright subjects, all succeeded: *A* in 4½ minutes, *F* in 3¾ minutes, *C* in 2¼ minutes, *D* in 4 minutes. The tendency in general was to try matches that were adajacent or opposite. Only *E*, *G*, and *B* gave evidence of choosing squares rather than individual matches. It was also noticeable that of group II only *L* and *M* gave evidence of making any attempt other than by actual removal of matches, while all of group I, except *A*, did so. None of the subjects attempted a logical, mathematical solution like that suggested by Miss Thompson.

Problem 3. A man travelling with a fox, a goose, and some corn comes to a river. He can only take one over at once. If he leaves the fox and goose together, the goose will be eaten. If he leaves the goose and corn together, the corn will be eaten. How can he mange to get them all safely over?

Conditions. The subject was provided with small wooden blocks of different shapes representing the different objects. These he carried over a book (representing a river) to demonstrate the solution. To solve this puzzle alone rquires a good deal of ingenuity. The important idea, of course, is that of carrying the goose back. This is in the nature of a "catch," and did not occur to any of my subjects. After 10 minutes of unsuccessful trials it was explained that it would be allowable for the man to carry any of them over and back again if he cared to do so. Five minutes more were then allotted. In case of failure again, they were then instructed that the goose was the proper one to carry back.

Results. None of the subjects were successful without as-

sistance. After the first bit of instruction, all but *E* of group I, and *H* and *J* of group II were successful. The remaining ones were successful after the second bit of assistance. It is interesting to note how quickly the pupils learned that the solution must begin by the man carrying the goose over. This is the first essential point, and was seen at once by all except *E*, *I*, *K* and *N*. These continued their false starts for some time even after they had been found to lead to failure. The ingenious, "smart" suggestions nearly all came from *J*, *K*, and *M*. Some of these are as follows: "separate them on the opposite bank," "hurry back before the fox can eat the goose up," "let the fox swim over," "call the fox over," "put the corn in his pocket," "throw the corn over," "hide the corn," "tie up the fox," etc. This may signify a greater difficulty for these subjects in comprehending the conditions of the problem, or a greater aversion to making any serious effort at doing so.

Problem 4. Two boys and two men are travelling and come to a river which has no bridge and is too deep to wade. None of them can swim. They find a small boat which will carry two boys or one man. How can they manage it so that all may get over?

Conditions. The subjects were given a toy boat and blocks representing boys and men. Each was allowed to keep trying not only till successful but till the process was completely learned and could be gone through without error.

Results. The following shows the time in minutes spent by each subject in actual trials before all the errors were avoided. Time spent between successive trials is not counted.

GROUP I.

A	B	C	D	E	F	G
7.27	1.36	1.58	2.20	5.41	x	5.25

GROUP II.

H	I	J	K	L	M	N
1.15	9.25	5	10.33	2.45	9.27	17.47

The total number of errors for group I was 35, distributed among six subjects (*F* was not tested), *A* and *E* being responsible for 20 of them. For group II there were 87, *K*, *M*, and *N* having 61.

The most frequent error in both groups was that of a man going over and coming back at once, and the next that of a boy going over alone.

The following shows the number of trials made by each subject before all errors were avoided.

GROUP I.

A	B	C	D	E	F	G
6	1	3	3	5	x	1

GROUP II.

H	I	J	K	L	M	N
2	8	5	14	3	8	10

After the subject had learned the moves using the blocks he was told to close his eyes and describe the necessary moves orally. All were able to do this without hesitation except *M*, who made several errors.

Thereupon the subject was allowed to close his eyes while I named the moves orally. Then I would stop suddenly and have him state the situation resulting from my instructions. *I*, *K*, and *M* had great difficulty in this, being able to follow only short, simple moves.

There are several factors that make for success in this problem. The effect of various possible moves may be pictured in advance by imaging the blocks in other positions than those which they occupy. It may be objected that even the subjects able to do this will not do so, but rather depend on lucky moves to bring it around all right in the end. It is true that in some cases boys of group I do begin with haphazard moving. But the significant fact is that they abandon this procedure after a few moves for one which is more rational. Instead of making a trial and letting the result tell whether it is correct, they try to foresee what will result from a contemplated move.

It may be objected also that a subject may be successful simply because of making a lucky move early in the test and then repeating it mechanically. But here is an important point. Certain of the subjects, when successful by accident, stopped to find out the cause of the good fortune. Certain others went on repeating the old errors or making new ones. The table shows the marked inferiority, generally speaking, of group II on this test. But in no case was the procedure entirely haphazard. Even the poorest cases, as a rule, began by taking over two boys. The most obvious possible errors were hardly made at all. This partial avoidance of the trial and error method shows that the subjects were really employing their intellectual capabilities in solving the problem. Whether they were doing so to their utmost, it is impossible to determine.

After solving the above problem the subjects were asked to show how seven men and two boys could get across the river in

this same boat. All were successful at the first attempt except *H* and *K*, who succeeded on the second trial. *B*, *G*, and *C* volunteered the information that any number of men could be taken across that way.

Problem 5. A mother sent her boy to the river to get four pints of water. She gave him only two vessels, one holding three pints, the other five pints. The boy must bring exactly four pints, no more, no less. How shall he measure it?

Conditions. The subject was given vessels of the proper sizes and taken to the tap to demonstrate the solution. In order to avoid all unfairness it was explained that the boy would be allowed to pour water from vessel to vessel as much as he desired. Since the measuring may be begun by filling either vessel first, uniform conditions were secured by instructing each subject to begin with the three pint vessel. There are then the following steps to go through: 1. Fill the three pint vessel and empty it all into the other. 2. Fill the three pint vessel again and empty out two pints by filling the other full. 3. Empty the large vessel and use it to save the one pint remaining in the small vessel. 4. Fill up the small vessel again.

In case of failure at the end of 10 minutes the subject was reminded of the two pint space left in the large vessel after the three pints had been put in. Then if unsuccessful after ten minutes he was carried through step 2 above. If unable to proceed after ten minutes more, step 3 was given.

Results. None succeeded without assistance. *B*, *D*, *G* and *J* were able to proceed after being simply reminded of the two pint space. *H* and *L* were able to work out the last two steps alone while all the other subjects were able to get only the last step. Although it was very carefully explained that guessing would not be allowed and that the water must really be measured, nevertheless certain of the subjects could not be made to omit it. By "guessing" is meant any attempt to get a particular amount without actually measuring it. *A*, *E*, *I*, *K*, *M* and *N* were especially prone to this procedure. When one sort of "guessing" was forbidden they would try another. *B*, *D*, *F* and *G* refrained from it after being reminded once or twice. Generally speaking, the subjects of group II made far more useless trials than did those of group I.

The problem, considering the assistance given at the beginning, is entirely fair and gives room for a good deal of ingenuity. A distant end must be kept in mind and various possible combinations tried in order to see whether they further this end.

Problem 6. The subject was given six pennies and told to arrange them in two rows of four pennies each. If not suc-

cessful in 10 minutes he was told that it was allowable to place one penny on top of another if he cared to do so.

Result. *F* and *J* were successful without help. The others failed in the 10 minute period and were given the above mentioned assistance. Thereupon all succeeded within five minutes, except *A*, *M*, and *N*. With this puzzle, group I made many more trials than group II. *A*, *C*, and *G*, especially, made their combinations very rapidly, while *F*, *J*, *K*, *L* and *M* made few trials.

Constructive imagination in Chess. The details concerning the chess test are given in Section VIII, but since ability to plan the game is closely associated with invention and constructive imagination I have incorporated the ranking in chess playing with the ranking for the tests of this section in Table I.[1]

TABLE I.

Grading and Ranking of Subjects on Tests of Inventiveness.

Problem.	1	2	3	4	5	6	Chess.	Composite Ranking.
A	5	2	2	4	3	1	3	10
B	2	1	1	1	1	2	1	1
C	2	2	1	2	2	2	2	4
D	1	2	1	2	1	2	3	3
E	2	1	2	3	3	2	3	9
F	3	2	2	3	2	1	3	7
G	2	1	1	1	1	2	2	2
H	3	3	1	1	2	2	3	5
I	5	3	2	4	3	2	4	11
J	3	3	1	3	1	1	4	7
K	3	3	3	5	3	2	5	13
L	1	2	2	2	2	2	4	5
M	4	2	3	5	3	3	5	14
N	2	2	2	5	3	3	4	11

Table I gives a summary of the results of Section III so far as they concern the relative ability of the individuals tested. The method employed was to assign to each boy a grade on the scale of 3 or of 5 as

[1] That our puzzle-problems really did involve constructive imagination is indicated by the close correlation found between the rankings that they give and that for chess, which involves the latter in a high degree.

the precision of the test permitted, 1 being the highest mark. The composite ranking is calculated by summing the grades given for the individual tests and assigning a new mark in accordance with the sums obtained, the rank 1 being assigned to the boy having the lowest total, and so on. In case the sum of the grades for the individual test turned out the same for any two boys, both were given the same rank and the next rank number was omitted altogether. In Table I, for example, *H* and *L* are both ranked 5 in the composite ranking, and rank 6 is omitted; in the same way *F* and *J* are ranked 7 and the rank 8 is omitted.

On the basis of this table we are able to throw our subjects into five groups according to their inventive ingenuity (of the mechanical type). 1. *B* and *G*, who are almost uniformly good. 2. *C*, *D*, *H* and *L*. 3. *E*, *F*, and *J*, who are rather irregular. 4. *A* and *N*. 5. *I*, *K*, and *M*, who stand distinctly lowest.

The second and third kinds of invention have barely been touched by my experiments, but several important points have come out incidentally. For example, as mentioned elsewhere, *C* is distinctly of artistic temperament, with a passion for drawing and painting and a marked liking for works of fiction. *N* belongs to the lively, imaginative, unstable type of stupidity distinguished by Kraepelin from the dull type. *L* is somewhat of the same type but less distinctly so, and frequently rises out of the stupid class. *H*, *I*, *J*, *K* and *M* approach Kraepelin's dull type, and show little invention of any kind. *B* and *G* show the highest development of the power in question. Their inventive ability belongs rather to the mechanical sort.

As a group, the duller boys make many trials with slight variations and do not study the situation before attacking it, both of which characteristics testify to their feeble ability to present to themselves anything beyond what actually lies before them. They tend, like the animals, to live in a world of immediate sense experience.

Well chosen puzzle problems seem to the writer to furnish a satisfactory general test for imagination of the every day practical sort. It is clear, however, that subjects of good ability may fail in one or two special cases, and subjects of poor ability succeed, so that the test should be carried out with a sufficiently varied assortment of similar problems. The tests throw much light also on methods of logical procedure, and will be considered in this respect at the close of the next section.

IV. The Logical Processes.

The second series of puzzles was devised to throw light on the degree of development of the logical processes, to get at differences in methods of mastering intellectual difficulties.

No doubt the broad outlines of this phase of mental development are familiar to the reader. It is a matter of common information that the lowest forms of life profit little or not at all by experience, and that the ability so to do has been generally agreed upon as the best criterion of a conscious life. The classic example of Möbius's pike may be taken as representative of the next higher stage. The pike ceases his efforts to devour the small fish after he has half killed himself by bruising his head against the plate glass that separates them from him. He also leaves them undisturbed even after the partition has been removed. No other adaptability is shown. In other words we have an example of associative memory, but one very difficult to stamp in.

The higher animals, such as the rat, or monkey, show vastly increased ability to reach a desired end through memory of success and error. The problem is attacked in a haphazard way until accident brings success. If rational processes were very effective here the animal would look about for the cause of his success and thereafter avoid error and discard superfluous movements. As a matter of fact this is not the case; errors and useless movements are eliminated only gradually and in proportion as the successful activities become more firmly grounded in neural structure as habit. The typical curve of learning, then, by the "trial and error method" is one of *gradual* descent. This is the sort of learning characteristic of animal intelligence.

The logic of the learning processes in children has been studied experimentally by Hodge (7), Lindley (11), and Kinnaman (9). They show that the methods of young children in approaching a problem are essentially like those of the rat or monkey, namely a series of haphazard trials, a lucky accident, and gradual elimination of the useless efforts. But a significant fact is that the curve presents a steeper descent than is the case with animals. Error may be repeated, but not so often. The work of Lindley shows that at about the ages of ten or twelve the "trial and error method" is giving place to a more rational procedure. "The lack of circumspection, the conventional beginnings, the automatic repetition of former movements, the slight and inconsequential variations, the frequent relapses into routine after failure of a slight variation, in short, the general tardiness in profiting by errors, of children of grade III, slowly makes way in older children for greater prevision, more adequate analysis of design, less conventionality and automatism in procedure, more radical reconstruction of plans in successive trials, all of which leads to greater promptness in profiting by mistakes." (11, p. 469.) Kinnaman's experiments show a similar improvement in the adult as compared to the

child. They are able, also, to learn by the experience of others as well as by their own.

But we need not break off our comparison at this point. Adults themselves show the greatest differences in this respect. The noted inventors and the experimentalists have shown ability to profit by error and happy chance far surpassing that of the ordinary person, intricate errors often being second in importance only to truth itself. For the scientist, negative results may be almost as valuable as positive. The history of invention is a record of success built upon failure.

To sum up the course of development just traced, we may follow the example of Mezes (15) and lay down three tolerably well defined stages. 1. "Trial and error." 2. Action that is purposive, but not chosen. 3. Action that is purposive and chosen. To animals Thorndike grants the first only, and asks us to close the question on his decision. On the other hand, Hobhouse seems to prove that certain animals, at least, partake of the second grade. No one, however, would ascribe to them the third sort. As pointed out by Mezes, they may know that a certain action produces a certain result, but not why. They do not scrutinize a situation with a view to discover the best mode of procedure. "They do not even ask *double* questions, still less *general* ones." The reasoner, morever, breaks up a problem into its parts, while the monkey, the child, or the stupid man deals with it as a whole and is soon balked. The reasoner hunts for his error, the animal only knows that the trial was unsuccessful; it does not ask why. Our fourteen boys present a tolerably long scale of differences in this particular.

The following is a summary of the results gained with them from the four puzzles bearing upon this question.

Problem 7. A ball is lost in a round field. The grass is so tall that you can only see ten feet on each side of you. Show what path you would take in looking for the ball.[1]

Results. The subject was given pencil and a piece of paper on which was a circle to represent the field. They fall, according to procedure, into four groups. 1. Those who began at the circumference and circled round and round spirally to the center. This includes *C*, *E*, *F*, *G*, *H* and *L*. 2. *B* and *A* began at the edge and marked across from side to side in parallel lines until the whole field was covered. 3. *K* and *N* marked out a path that resembled somewhat the shape of a wheel with spokes, but was more irregular. 4. *D*, *I*, *J* and *M* ran the pencil about apparently at haphazard until the whole circle was marked over.

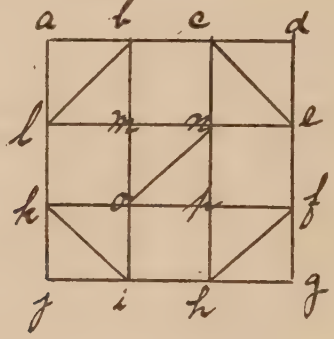
[1] This problem is borrowed from Dr. C. F. Hodge.

Problem 8. Trace the following figure without crossing a line, lifting the pencil, or tracing any part twice.

Results. *A*, *B*, *C*, *D*, *E*, *F*, *H*, *K* and *L* succeeded the first trial, *G*, *I*, *M* and *N* the second trial, and *J* the fourth.

The solution, of course, is very simple and cannot be missed if the tracer looks at all ahead of his pencil. It will be noted that only one of group I, but four of group II, failed at the first attempt. This may reasonably be interpreted as indicating a greater tendency in the stupid subjects toward what has been called perceptual thinking. Instead of the action being governed by an end, each stage of the process is motivated mechanically by the preceding stage.

Problem 9. Trace the following figure without lifting the pencil and without retracing.[1]



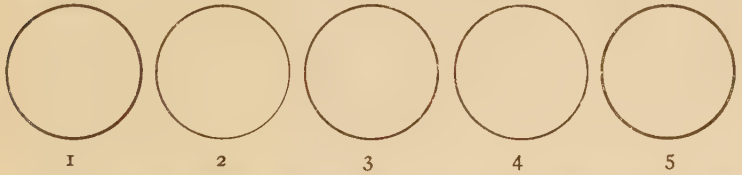
The following table shows the time, the number of trials, and the starting places for each subject.

Subjects.	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Number of trials,	7	6	5	2	11	10	3	4	8	12	11	13	4	3
Time in minutes,	30	17	21	6	38	53	7	8	30	41	23	37	28	8
Starting points in order,	a g a g c g n	j j i j j o	b a a d n	j n	e g g h i i i i i o	e d c d d d i i a n	h a o	a j k o	j a d a g a a n	a l p p g a b a p p n	j f f f f i f f f f l o	a a a a a a a a a a a n	a a a n	j j o
Grade on scale of 3.	2	2	2	1	3	3	1	1	2	3	3	3	1	1

[1] Taken from Lindley: A Study of Puzzles: *American Journal of Psychology*, July, 1897, p. 461.

The table shows very frequent repetition of the same error in subjects *E*, *K*, and *L*. Out of the total of 44 trials for the bright subjects there are possible 37 changes of starting point. 21 changes were made—a percentage of 56+. The percentage of change in starting point was only 39+ for the stupid group. This difference corresponds to that found by Lindley between young and older children. In general my results on this test are so similar to age differences found by Lindley that we need not describe them in detail. They may be summed up by saying that subjects who did best showed less repetition of errors, and a tendency to make variations of a more radical nature, when at all. I may say, however, that the groups fell less radically apart in this test than I had anticipated.

Problem 10. Five circles were marked out thus on cardboard:



Black checker-men were placed on 1 and 2, and white ones on 4 and 5. The problem is to make the black and white men exchange positions. A piece may move forward one step or

TABLE II.

Times, trials and relapses with problem 10.

	Five circles.			Seven circles.			Nine circles.			Eleven circles.			Thirteen circles.			Grading on scale of five.
	Time.	Trials.	Relapses.	Time.	Trials.	Relapses.	Time.	Trials.	Relapses.	Time.	Trials.	Relapses.	Time.	Trials.	Relapses.	
A	3+	5	0	21+	36	2	No further trouble.									3
B	1+	3	0	1+	3	1	No further trouble.									1
C	7+	28	4	2+	6	1	5	0	No furth. trouble.							3
D	4½	10	1	6	7	1	3	0	No furth. trouble.							3
E	1⅓	4	1	16	25	2	2	0	No furth. trouble.							3
F	2	6	0	9¾	15	0	No further trouble.									2
G	4+	11	3	1½	2	0	No further trouble.									2
H	16+	30	4	19+	50	5	11	4		4	1		3	0		5
I	6+	12	3	11+	16	1	4	0		13	3	No trouble				4
J	15+	34	5	7+	19	2	24	5	No furth. trouble.							4
K	17+	28	7	12+	18	3	13	3		2	0		2	0		5
L	14+	22	4	21	26	6	No further trouble.									3
M	49	24	6	32	35	6	16	2	No furth. trouble.							4
N	3+	6	1	30	42	5	8	2	No furth. trouble.							4

jump over one piece, but cannot move backwards. After the solution for this was learned, seven circles were given with three men at each end. Afterward, nine circles with four men, then eleven circles with five men, then thirteen circles with six men at each end. As in all the other tests, record was kept of every move. The table above shows the chief facts in the results.

Time is represented in minutes. It was not kept for the nine circles trial, or those succeeding. Number of trials means the number after which no error was made for five successive trials. The number does not, however, include these five final and successful trials. By "relapse" is meant falling back into error after having been successful.

The above table shows in a striking degree the difference in the ability of the boys in grasping and generalizing the essential features of a method of procedure.

The following is my estimate of the composite ranking of the boys for the tests on the degree of development in logical procedure.

GROUP I.

A	B	C	D	E	F	G
5	1	3	6	8	4	2

GROUP II.

H	I	J	K	L	M	N
10	12	13	14	7	11	9

As before, *E* and *L* tend to depart from the group to which they were originally assigned.

Taking into consideration the whole group of ten problems—those described in the previous section as well as those just considered—we may say that the boys of the better group showed not only superior power of imagination but also a stronger tendency to psychical economy; they used their eyes instead of their fingers; or, going still further in the same direction, they experimented mentally instead of by actual manipulations; they studied things out before they began to operate; they tended to abstract from the particular problem and to announce general rules. When, as often happened, they began in a haphazard manner, they more quickly eliminated their errors, and in adopting new lines of procedure chose them less at random. They were at times interested to seek the causes of their successes. In general, the more poorly endowed may be expected to make more trials than the better endowed; but in a case where no clue presents itself readily, as for example in the case of Problem 6, and the better

endowed are brought down also to the fumbling stage, the latter will probably be found to make the greater number of attempts. *B* and *G* showed the greatest advancement in logical procedure, abstraction, general range of knowledge and interpretation of it.

These problems, with perhaps the exception of Problem 8, seem well suited to their purpose. The last is eminently adapted for bringing out differences in degree of rationality of procedure. In several respects it is the most significant of the puzzle problems.

V. Differences in Mathematical Ability.

Ethnology shows that racial progress has been closely paralleled by development of the ability to deal with mathematical concepts and relations. Child psychology shows the same for individual development. This parallelism hinges on the importance of abstraction as a kind of intellectual short-hand. Without it we are helpless in mathematics and all else.

It was thought advisable, therefore, to investigate pretty closely the mathematical ability of my subjects. Eight sets of problems were given, involving more or less different phases of mathematical ability. Following we have a statement of the sorts of problems and a brief summary of the results with each sort.

1. *Mastery of the fundamental processes.* Fifteen problems were given, such as the following:

I. (1) $2+2+2+2-3-2+3=?$
(2) $3-1+2+1+5-2-1=?$
(3) $1+4-2+4-1-1+2=?$

II. Fifteen slightly more difficult, such as

(1) $4+6-3+8+2-4-3=?$
(2) $5-4+8+3-6+5-2=?$
(3) $7+2+3+3-5+2-4=?$

III. Fifteen, of which the following are samples.

(1) $2+3-1\times 2-3+1\div 2=?$
(2) $4-2-1+3\times 3-3\div 3=?$
(3) $1+6-2\times 3-5\div 2-3=?$

Conditions. As in most of the other work, the subjects were taken singly. The problems were read aloud by me at a uniform rate and the subject called out the answer aloud.

Pencil and paper were not allowed. Ten seconds were taken for reading each problem in the first list, twelve for the second list, and fifteen for the third. Full records were kept of the time required for answering each problem.

Results. Wide differences appear, generally speaking, between the two groups. The subjects may be classified as fol-

lows: *A*, *B*, *C*, *E*, *F* and *G* made no more than three errors out of the 45 problems and omitted none at all. *D* and *L* either omitted or answered incorrectly 6. *H*, *I*, *K* and *N* omitted or answered incorrectly between 10 and 16. *J* and *M*, 26 and 29 respectively. As to *time* required, *A*, *B*, *C*, *D*, *E*, *F*, *G* and *L* gave their answers with practically no delay; *H*, *I*, *J*, *K* and *N* with delay usually of 5 to 15 seconds; *M*, 30 to 50, seconds.

2. *Fractions.*

(1)	Ten problems such as:	What is ½ of 8?, ⅓ of 12?
(2)	Ten such as:	What is ⅓ of 18?, ¼ of 20?
(3)	" " " " "	⅔ of 8?, ¾ of 16?
(4)	" " " " "	⅓ of 16?, ¼ of 19?
(5)	Five " " " "	⅔ of 31?, ¾ of 11?

Conditions were the same as in the former problems; I read the problem, the subject gave the answer without the aid of pencil or paper. *Results.* *A*, *B*, and *G* were able to solve all the different kinds of problems given, and gave incorrect answers to no more than 5. *F*, *D*, and *L* were unable to solve those of the last list, and gave between 1 and 4 incorrect answers in the other lists. *E* and *C* could not solve those of the last list and missed 10 and 16 respectively among the others. *H*, *N*, and *I* could solve none in the last two groups. *K* and *J* none in the last three, and *M* could do nothing with any after the first group. According to *time* we have four distinct groups. 1. *B*, *F*, and *G* very quick. 2. *A*, *D*, *L*, *E*, *J*, *C* distinctly slower. 3. *H*, *I*, *N* and *K*. 4, *M*, by far the slowest of all, his average time for the simple problems of the firsr list of fractions being more than 18 seconds.

3. *Changing money.* Twenty problems were given, such as the following. How much money should I receive if I buy an article that costs (1) 35 cents and I give the clerk 50 cents?

(2) 14	"	"	"	"	"	25	"	?
(3) 69	"	"	"	"	"	$1		?
(4) 40	"	"	"	"	"	$1		?

Results. *A*, *B*, *F*, *G*, *N* were correct in all cases. *D*, *E*, *L*, *C* and *H*, answered incorrectly two to four times each. *I*, *K*, *J* and *M* answered incorrectly between six and ten times. As to *time*, five groups are readily distinguishable. 1. *B*. 2. *F*, *G*, *C*, *L*. 3. *A*, *D*, *E*. 4. *H*, *J*, *K*, *N*. 5. *I*, *M*.

4. *Conception of the simple mathematical relations of chance.* Twenty problems were given, of which the following is a sample. Twenty purses are lying on the table, all are empty except one, which contains $20, but you have no idea which one it is that contains the money. How much could you afford to give to be allowed to draw one of the purses. In the other problems the amount of money and the number of empty

and filled purses were changed about so that it soon became perfectly evident whether the relations involved were grasped.

Results. 1. *A*, *B*, and *G* gave the correct answers to all. 2. *C*, *E*, *H* and *N* gave answers varying roughly but not exactly according to the conditions; most, however, being incorrect. 3. *D* and *F* varied their answers very slightly according to the conditions, practically all being incorrect. 4. *I*, *J*, *K*, *L*, *M*, showed no comprehension at all of the relations. For example, *J*, after a few problems, settled on $1.00 as the answer for all. When asked why he answered $1.00 for all the problems, he said, "Because that ain't much." *K* and *L* always estimated the worth of a draw at a little less than the sum contained in the purse; the former because "you are sure to earn 50 cents if you draw it," the latter because "If you draw it then you are $1.00 ahead."

5. *Problems involving the relations of measuring vessels.* This division included the following nine problems:

(1)	With a	7	and a	5	pint	vessel	how	measure out	10 pints?
(2)	"	"	"	"	"	"	"	9	"
(3)	"	"	"	"	"	"	"	8	"
(4)	"	7	and	11	"	"	"	13	"
(5)	"	"	"	"	"	"	"	15	"
(6)	"	"	"	"	"	"	"	10	"
(7)	"	13	and	9	"	"	"	17	"
(8)	"	"	"	"	"	"	"	14	"
(9)	"	"	"	"	"	"	"	18	"

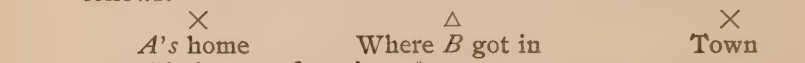
These problems are of exactly the same form as that coming under division 5 of the puzzle group. For that one, however, quite a different sort of mental ability is demanded than for the problems here given. For these, no vessels were supplied, but only the numbers representing the size of the vessels, together with pencil and paper. Since the boys now understood the general nature of these problems the puzzle aspect was no longer present. The solutions, however, are still of sufficient complexity to demand careful attention. Rapid combinations must be made, and as there are usually several steps in the solution, the result of the first stages of the process must be kept in mind while the last stages are being completed.

Results. *A*, *B*, *C*, *D* and *G* solved each within the five minutes allotted. *E* failed on one, *F* and *J* on two, *I* and *N* on three, *H* and *K* on four, *L* on five, and *M* on seven. The *time* is here very significant. *B* finished eight of his solutions in less than one minute each, *D* seven, *A* six, *C* and *E* five, *G* four, *J* and *F* three, *H*, *L*, and *N* two, *K* and *M* one, and *I* none.

6. *Problems involving the sharing of expenses.* This was a

series of three problems, and, like most of the other series, of increasing difficulty. (1) *A* hires a carriage for $4.00 to drive to town and back. When half way there he overtakes *B* who wishes to ride with him. *A* allows him to do so on condition that *B* will share half of what the carriage costs for the distance he rides. How much does *B* owe *A* if he rides on to town and then back to the half-way spot where *A* took him in? (2) Same kind of problem except that the carriage cost only $1.50 and instead of taking in only one man he took in two, each of whom was to pay his share for the portion of the journey he rode. In the 3rd problem the cost of the carriage was $12.00, while *B* and *C* were taken in after one-fourth of the journey had been made.

Conditions. In order to avoid the difficulties in the wording of the problems, I illustrated them with paper and pencil as follows:



The other problems were objectified similarly, and care was taken to repeat the statement until the subject understood the conditions, or until it was seen that he had not the ability to do so. When the solution was not reached within 10 minutes I gave a suggestion by pointing out what the entire cost of the carriage would be from the point where *B* entered, on to town, and back again to the same point. In case the solution was not reached within ten minutes more, I myself explained the solution to the subject very carefully and then allowed him to try the succeeding problem.

Results. 1. *A*, *B*, *C* and *G* solved all without help. 2. *D* and *E* failed on all in the allotted 10 minutes, but succeeded after the above mentioned suggestion was given them. 3. *F*, *L*, and *N* solved none, but gave some evidence of understanding the solution after it was explained to them. 4. *H*, *I*, *J*, *K* and *M* apparently understood nothing even after careful and repeated explanation.

7. *Problems involving the cost of two articles.* This group contains a list of seven problems. (1) I bought a bottle and a cork for $1.10; the bottle cost $1 more than the cork; how much did the cork cost? (2) I bought a horse and colt for $150, the horse costing $100 more than the colt. Find cost of the colt. The other five problems were analogous to these. The last one, however, involved a fraction and deserves special notice. (7) I bought a violin and bow for $20.00, the violin costing $15.00 more than the bow. Find the cost of the bow. This problem was inserted as a test to indicate whether or not the previous solution had been by rational procedure or simply

by trying different numbers until a combination was found that would satisfy the conditions of the problem. Pencil and paper were forbidden. When a solution was not reached in 10 minutes I explained the problem to the subject, and then let him proceed with the next in the list.

Results. Only two subjects solved the first problem, *A* and *G*. After the first, *A*, *B*, *D*, *E* and *G* had practically no difficulty, answering each within a few seconds. *L* and *N* also solved all after the first problem, but only after a good deal of fumbling on each one. *H*, *I*, *J*, *K* and *M* were as far from a solution of the last as of the first, although I did my best to explain each solution to them before setting them to the next. *C* had to be told the second, and thereafter had no difficulty. *F* failed on the second and also the last, showing that he had not evolved any rule.

8. *Problem involving the development of a rule.* I took a sheet of paper, folded it twice, in opposite directions, cut off the doubly folded corner, and before unfolding the paper, asked the subject to state the number of holes my cutting had made. After receiving the answer I unfolded the paper and allowed the subject to see whether or not his answer was correct. Then another sheet was folded similarly three times and the subject's answer to the same question recorded. The same was repeated for four, five, six and seven foldings. The rule in question is, of course, that the number of holes made by cutting off the corner of the folded sheet is doubled by increasing the number of folds by one.

Results. *B*, *C*, and *D* made no error. *A* made no error after the third trial, *G* none after the fourth trial, *L* got the last one correct, while the others, including *E*, *F*, *H*, *I*, *J*, *K*, *M* and *N* gave incorrect answers to all.

The following table summarizes the results for mathematical ability.

TABLE III.

Ranking for Mathematical Tests.

Sorts of questions.	1	2	3	4	5	6	7	8	Rank.
A	1	1	1	1	1	1	1	2	1
B	1	1	1	1	1	1	2	1	1
C	1	2	2	2	2	1	3	1	4
D	2	2	2	4	1	2	2	1	5
E	2	2	2	4	2	2	2	5	7
F	1	2	1	3	2	3	3	5	6
G	1	1	1	1	1	1	1	3	3

TABLE III.—*Continued.*

Sorts of questions.	1	2	3	3	5	6	7	8	Rank.
H	4	4	2	2	4	4	5	5	10
I	4	4	5	5	3	5	5	5	12
J	5	4	4	5	3	5	4	5	11
K	4	4	4	5	4	5	5	5	12
L	3	2	2	5	4	3	3	4	8
M	5	5	5	5	5	5	5	5	14
N	3	4	2	4	3	3	3	5	9

It is worth noticing that in these tests *E* and *L* do not depart from the groups to which they were assigned by their teachers. It suggests that rapidity and precision in number work may be a considerable factor in "brightness" in the school sense of the word. It is true, also, that with tests of this sort the amount of school training is apt to be a factor. Such problems, nevertheless, make demands upon the powers of logical and abstract thought and are not without value as a test of these matters. Upon such problems Hancock based his study of the reasoning powers of children.

VI. LANGUAGE.

It is useless to insist on language as an index of intellectual development. Language is not only the expression, but also the *sine qua non* of conceptual thought proper. Every stage of a child's development has its peculiar language interests and language capabilities. Perhaps more than any other one class of facts, language growth epitomizes the development of a child's intelligence as a whole. My observations in this field include 1 Reading, 2 Building words from given letters, 3 Correction of mutilated text, 4 Spelling, 5 Fluency of expression and 6 Facility in obeying oral commands.

1. *Reading*. The subjects were given an easy and interesting story about 600 words in length to read aloud. They were simply asked to read as well as they were able. Careful notes and gradings were made. Following is a summary of the results:

TABLE IV.

Records from Reading Tests.

	Grade.	Time.	Words not pronounced correctly.	GENERAL REMARKS.
A	2	5½	0	Fluent, fairly expressive, a little monotonous, voice not very strong, no repetition, no hesitation, no mispronunciation, easy to follow. Gets B at school on reading.

TABLE IV.—*Continued.*

	Grade.	Time.	Words not pronounced correctly.	GENERAL REMARKS.
B	1	4¾	0	Modulation almost perfect, no repetition, no mispronunciation, reads with more expression than do most educated adults, could read at 4½ years of age and at 6 could read anything. Gets A at school.
C	1	4½	0	Voice pitched rather high, very much expression, emphasis a little overdone, slight stammering now and then with repetition of one or two words, hesitates once in a while apparently to let thought catch up with language. A to B at school.
D	2	4¼	0	Very much expression, no repetition, no mispronunciation, emphasis placed almost perfectly, matter of fact tone of voice. Gets A to B at school.
E	3	4¾	4	Hesitates some, fair expression, voice soft and attractive, emphasis well placed. Gets A to B at school
F	2	4	0	No hesitation or mispronunciation, monotony of voice is worst fault, thought seems to run ahead of language now and then. Gets A at school.
G	1	3½	0	A little monotonous, rather too rapid, no hesitation, no mispronunciation, emphasis good. Gets A to B at school. (G is in grade 8 at school and his school rank is thus gained by comparison with pupils more advanced than most of mine.)
H	4	6	11	Voice husky and nasal, very monotonous, poor emphasis and expression, reads sentence by sentence as though they were disconnected. Gets C at school.
I	3	5¼	2	Fair expression, tolerably fluent, little mispronunciation, emphasis misplaced here and there, voice rather subdued, no hesitation. Gets B— at school. Likes reading.
J	4	6½	6	Tolerably fluent, stopped three or four times to spell words, voice rather coarse and monotonous, emphasis not often misplaced. Gets C at school. Likes reading.
K	4	8½	9	Slow, hesitating, apparently takes in only a small portion at once, unable to read fluently through short sentences, voice monotonous, emphasis misplaced often. Gets C at school.
L	3	5	1	Tolerably fluent, fairly good emphasis, little mispronunciation, repetition now and then. Gets B to C at school. Likes to read.
M	4	9	5	Very slow and hesitating, runs over punctuation marks, expression and emphasis not so very bad. Gets C at school. Dislikes reading.
N	5	15	51	Voice pitched high and wholly unnatural, extraordinarily monotonous, sing-song tone, very slow and halting, spells over about one-third to one-half the words, misplaces emphasis, pays little heed to punctuation. By far my poorest reader. Gets D at school.

For two weeks I tutored *N* daily one hour in reading. His reading is by small units. Phrases are apparently not thrown together into one mental content. I made special effort to correct this fault, thinking it possibly only a matter of habit, but with little success. In making the effort to read by larger wholes he miscalls and transposes very many words. I had also little success in trying to get him to tone his voice down to conversational pitch and to modulate it more naturally. Punctuation was little heeded. He has a very marked habit of reversing the position of words in a phrase and of separate sounds in a word. Very often he hits correctly on part of the sound of a word and fills in the rest incorrectly. For example, *as* instead of *so*, *saw* instead of *was*, *with* instead of *what*, *wistful* instead of *wise*, *icicles* instead of *ice crystals*. Such errors are made in almost every line. Careful re-examination showed no defect of vision.

To summarize the results on reading, I may say that the dull boys, as a group, are decidely inferior to the bright boys. They are less fluent, miscall more words, and have far less expression. The tone of voice is more monotonous and has more of the unnatural "schoolroom" pitch. The reading is evidently also by smaller units, phrases often being uttered separately as though unconnected. The frequently misplaced emphasis shows that fine shades of meaning are not grasped. Their rate is also decidedly slower, especially with *K*, *M*, and *N*. It must be kept in mind, however, that the stupid boys have done much less reading. (See Individual Sketches, Section XI below.) It cannot, of course, be determined how much of the difference is thus to be accounted for.

I believe that careful experimentation giving a detailed analysis of the reading process among these fourteen boys would have yielded important results. Even the mere verbal recognition of words involves the use of intricate mental machinery, and if there is a hitch at any part of it the process is seriously interfered with. Add to this more mechanical phase the accompanying interpretative processes necessary to good reading and we have opportunity for a wide range of mental ability to show itself.

In the first place, reading rate is a measure of the rate of association. Letters become associated together in certain combinations making words, words into word-groups and sentences. Recognition is for the most part an associative process. Rapid and accurate association will mean ready recognition of the printed forms. Since language units (whether letters, words, or word groups) have more or less preferred associations according to their habitual arrangement into larger units, it comes about that in the normal mind under normal conditions

these preferred sequences arouse the apperceptive complex necessary to make a running recognition rapid and easy. It is reasonable to suppose that in the sub-normal mind the habitual common associations are less firmly fixed, thus diminishing the effectiveness of the ever changing apperceptive expectancy. Reading is therefore largely dependent on what James calls the "fringe of consciousness" and the "consciousness of meaning." In reading connected matter every unit is big with a mass of tendencies. The smaller and more isolated the unit the greater is the number of possibilities. Every added unit acts as a modifier limiting the number of tendencies until we have finally, in case of a large mental unit, a fairly manageable list. When the most logical and suitable of these associations arise easily from subconsciousness to consciousness, recognition is made easy, and their doing so will depend on whether the habitual relations of the elements have left permanent traces in the mind.[1]

The reading of the sub-normal subject bears a close analogy to the reading of non-sense matter by the normal person. It has been ascertained by experiment that such reading requires about twice as much time as the reading of connected matter. This is true for the reason that out of thousands of associations possible with each word, no particular association is favored. The apperceptive expectancy, practically *nil* in the reading of non-sense material, must be decidedly deficient in all poor reading.

With the ordinary reader, also, there is a feeling of rightness or wrongness about the thought sequences. That my poorer subjects have this sense of fitness to a much less degree is evidenced by their passing over words so mutilated in pronunciation as to deprive them of all meaning. The transposition of letters and words and the failure to observe marks of punctuation, point to the same thing. In other words, all the reading of the stupid subject is (to him) with more or less non-sensical material.

2. *Word making.* Four trials were given, on different days, in constructing words out of given letters. The first test was ten minutes in length and the letters were t e i a b r. Record was kept of the number of words made during each two-minute period. The second test was the same with the letters m e k i a f g n. The third lasted only eight minutes and a different set of letters was given for each two-minute period. They were (1) r n a d o, (2) o s d n a e, (3) c d o b u v e r,

[1] I am indebted for much in the above discussion of the intellectual processes of reading to Dr. E. B. Huey's paper on The Psychology and Physiology of Reading, *Am. Jour. of Psy.*, 1900.

(4) p y a h n t e. The fourth was a similar test with the letters (1) k r e o p d a, (2) n t e s a i p, (3) b m o t a e k, (4) m o n e d i e. The following is the ranking obtained from these four tests.

GROUP I.

A	B	C	D	E	F	G
3	1	6	5	9	6	4

GROUP II.

H	I	J	K	L	M	N
13	11	8	9	2	14	12

A good many factors enter into the success of this sort of work. Much depends, of course, upon the vocabulary at command, and this in turn depends largely upon home training and amount of habitual reading as well as upon native retentiveness. A second factor is ability to spell, and habits of word analysis generally. Very important, also, is the use of a rational plan; some skipped about and made combinations at random, while others took the letters one by one and joined them in as many different ways as possible with the others. Lastly, the rate of shifting of attention, and the degree of mental inertia as opposed to spontaneity, also contribute to the total result.

Without going into details we may state that considering what the previous tests had revealed the results gained from this one are close to what one would have anticipated. *E*, *H*, *I*, *J*, *K*, *M* and *N* show least plan of procedure, just as they did in the puzzle series. The ones who are deficient in spelling, amount of reading done, ability to read, etc., also did poorly here. Perhaps the only surprise is that *L* did so well, though his reading and general command of language would cause us to expect him to far outstrip the others of his group.

3. *The Mutilated text.* Two trials were made of the Ebbinghaus test (5). 1. The subjects were given the following mutilated story and were told to fill the blanks as they thought it ought to be done.

THE STRENGTH OF THE EAGLE.

One —— —— eagle —— with the —— birds —— see —— could—— —— highest. ——— agreed —— he who —— fly —— —— should—— called —— strongest ——. All started —— —— same ——— and —— away among —— cl——. One by —— they ——— weary —— re———, but —— eagle —— upward and —— un——— —— was—— mere speck — —— heav——. When he —— back —— others were —— for him; and —— —— touched —— ——— a linnet —— off —— back where —— —— ——— hidden and —— that —— himself —— —— strongest ——. "—— —— stronger —— —— ——," said the ——"for not —— did I—— as high but —— he began —— downward —— I — my hiding —— and —— up ——little ——." —— this boastful —— the —— —— their heads

and —— — council to —— the matter. After —— long —— —— decided —— the —— —— the —— bird —— not only —— he —— so high, but —— —— the —— as well.

To —— day —— plumes —— —— —— are emblems of str—— and cour——

The results are summarized as follows:

TABLE V.

Test with mutilated text.

	Grade.	Time.	Errors. Making sense.	Errors. Making non-sense.	Errors. Blanks not filled.	GENERAL REMARKS.
A	4	35	30	31	0	Much non-sense. Haphazard. Steady rate.
B	1	26	9	0	3	Almost all correct. All makes connected sense. Quick, steady, looks ahead.
C	2	15	12	7	8	Lazy, attention relaxed. Calculates time it will take to finish.
D	2	17	25	10	0	Some idea of meaning as whole. Got the main idea. Worked hard. Works to get meaning.
E	3	35	21	23	0	Phrases well connected. Little meaning to sentences as wholes. Lost main idea. Rather inattentive.
F	2	30	24	6	0	Attempts sense. Original. Misses main point. All makes fair sense. Looks ahead one or two sentences.
G	1	19	10	0	0	Nearly all correct. Runs through to get meaning and fills easiest first.
H	5	15	24	43	2	Rapid, careless, got none of the story. Works by phrases, No sentences.
I	5	25	37	32	0	Nearly all non-sense. *E. g.*, two verbs together. One word on two blanks and *vice versa*. No lack of confidence, no hesitation.
J	4	45	37	29	0	Fills it as a number of fragments. The sentences have no connection. Filled blanks steadily.
K	5	25	28	36	0	All non-sense except one or two easy parts, Phrases at a time. Confident. Little hesitation, steady.
L	3	35	6	6	25	Tries to make sense but omits much because he can't get the crucial sentences. Does well what he fills. Wants to quit because he can't understand it.

TABLE V.—*Continued.*

	Grade.	Time.	Errors.			General Remarks.
			Making sense.	Making non-sense.	Blanks not filled.	
M	5	40	8	2	61	All omitted but very easiest parts. Worked hard. Runs through all the story but can get no meaning.
N	3	14	12	7	27	Rather careful to avoid non-sense. Attention relaxed. Had to be encouraged.

The following gives an idea of the amount of difference between one of the best and one of the poorest.

B. One day an eagle went with the other birds to see who could fly the highest. They agreed that he who could fly the highest should be called the strongest bird. All started at the same time and flew away among the clouds. One by one they became weary and returned, but the eagle went upward and upward until he was a mere speck in the heavens. When he came back the others were waiting for him; and when he touched the ground a linnet flew off his back where the thief had hidden and said that he himself was the strongest bird. "I am stronger than you are" said the linnet, "for not alone did I fly as high, but as he began flying downward then I left my hiding place and flew up a little higher." But this boastful —— the —— —— their heads and went to council to decide the matter. After a long time they decided that the eagle was the strongest bird, and not only because he flew so high, but he had the strength as well. To this day the plumes of the eagle are emblems of strength and courage.

K. One with the eagle and with the small birds and see who could fly the highest, and agreed and he who will fly the higest should be called the strongest they All started in the same place and whent away among the clouds. One by one they were weary and returned, but the eagle flew upward and could less he was in mere speck and was heavy. When he came back the others were gone for him; and so he touched his wing a linnet and off whent back where he was then hidden and thought that he himself was the strongest I, "am the stronger and so he" said the brid, "for not and did I go as high but then he began to downward and I in my hiding place and whent up a little high." and this boastful in the way of their heads and had a council to take the matter. After a long while he decided that the king of the little bird and not only and he was so high, but he did the thing as well. To more day can plumes and so they are emblems of strait and course.

2. In order to rob the test of its puzzle nature a second trial was given with the following mutilated story; but in this case the complete story was read aloud to the subject first. He therefore knew the general sense and had a much narrower field to hunt over in the search for suitable words.

WHY THE MOLE IS BLIND.

An Indian once —— —— —— into cloud ——. Then —— —— ——

trap —— ——, laughing to —— how —— would —— ———. The —— did —— ——— back, but ——. The —— on —— daily —— ——— right —— —— ———.

When —— bright ——— —— —— come the —— began —— be ——, and when —— found his —— had —— —— fast he —— ——— know —— —— do.

He tried —— —— near enough — —— the cords, but —— —— from the —— ——— him and he gave —— ——.

Then —— —— many —— to try ——, but —— all found —— ——— too ——. At —— the —— ——, "I will —— through —— —— under the —— and so get at —— ——."

This — ——, and the —— —— up —— —— h——.

But it —— so —— that the poor —— —— not —— ——, and the —— of —— —— —— out his ——.

——— then the ——— have had —— —— —— dark —— and unless one —— very ——— he —— —— find ——— ———.

The following table summarizes the results:

TABLE VI.

Results of test with mutilated text.

	Grade.	Time.	Errors.			General Remarks.
			Making sense.	Making non-sense.	Blanks not filled.	
A	2	25	30	7	2	All fair sense. Phrases now and then wrongly turned. Goes over it all and fills easiest first.
B	1	17	34	0	0	All good sense, but large changes made. Very careful with every blank.
C	1	9	18	0	0	All good sense. Only slightest changes. Whispers a good deal.
D	1	11	18	3	0	Nearly all makes sense. Much whispering. Works by fits and starts.
E	2	24	27	0	13	Fair sense but for the omissions. Several changes. Works steadily.
F	1	17	17	0	1	Good sense. Only very slightest changes. Worked steadily.
G	1	13	14	0	0	All the sense good. Only very slightest changes. Works through it as a whole.
H	5	15	19	56	5	Nearly all non-sense. Jumbled in all sorts of ways. Often two words in one blank. Very little hesitation.
I	4	30	39	31	10	Sense here and there, but great changes and much non-sense. Extra words inserted. Fills by phrases. Worked steadily.

TABLE VI.—*Continued.*

	Grade.	Time,	Errors. Making sense.	Making non-sense.	Blanks not filled.	GENERAL REMARKS.
J	3	25	28	8	16	Fairly good in almost half, rest poor. Some non-sense. A few extra words inserted. Fills by phrases. Worked very hard.
K	3	18	33	20	0	Much non-sense. Very many errors that change meaning. Extra words inserted. No hesitation.
L	2	30	36	0	8	Much better than others of this group. Many phrases turned but sense kept. Original in expression. Goes through to get sense.
M	5	30	30	3	47	Only about half filled, most of this wrong. Runs through it as a whole but can't get meaning.
N	3	25	24	4	14	Most of it makes sense but many phrases changed. Much whispering. Has to be encouraged.

Following are samples of the work of the two groups.

F. An Indian once chased a squirrel into cloudland. Then he set a trap for him, laughing to see how he would catch him. The squirrel did not come back, but—! The sûn on his daily trip jumped right into the trap. When the bright sun did not come the Indian began to be frighten, and when he found his trap had the sun fast he did not know what to do. He tried to get near enough to losen the cords, but the heat from the sun scorched him and he gave it up. Then he got many animals to try it, but they all found the heat two great. At that the mole said, "I will dig through the ground under the trap and so get at the sun." This he done, and the sun went up to the heavens. But it went so fast that the poor mole could not get out, and the heat of the sun put out his eyes. So then the moles have had their homes in dark places and unless one looks very sharp he cannot find the mole.

H. An Indian once taued [chased] a squared [squirrel] into cloud after him. Then he sairtng [setting] that trap would catch him laughing to himselft how would would he catch him. The squared did not come back, but sun The day on one daily the Indian right did not catch sun. When sun didnt bright Indian the he come sun began sun to be there, and when Indian found his trap had caut sun fast he did not know what to do.

He tried to gether near enough but tried the cords, but sun was from the hot and him and he gave it up. Then he again many time to try but he all found it was to heard [heat]. At then the Indian, "I will call through amigle [animals] under the the and so get at the trap." This mole said, and the he get up then ued [under] hearth [earth.] But it he was so quik out that the poor mole could not get out well, and the ——— of —— —— —— out his ———. But then the mole have had to live in the dark but and unless one come very quik he was found find blind mole.

The results of the two tests run closely parallel. With certain exceptions the two groups are widely separated in each. *A*, however, ranks below *L* in both tests and below *N* in the first. *E* is also rather poor. *H*, *I*, *J*, *K* and *M* stand far below all the others.

Ebbinghaus regards this test as a reliable measure of intellectual ability. The following is his description of that ability. "It does not depend upon knowing many things, *i. e.*, upon the reappearance in consciousness of definite individual impressions and on reacting to these with ideas one has already associated therewith. It is much more complex, more creative. Its essence lies in comprehending together in a unitary, meaningful whole, impressions which are independent of each other and answer to associations which are heterogeneous and partly contradictory. Intellectual ability consists in the elaboration of a whole into its worth and meaning by means of many-sided combination, correction, and completion of numerous kindred associations. . . . . It is a *combination* activity."

My experience with the test causes me to regard it favorably; but like all others, if taken alone it can only give a partial account of the subject's ability. It certainly does indicate something as to the general command of language. I am inclined to think that somewhat mechanical activities like memory and association, as distinguished from synthetic or combinative processes, play a relatively more important rôle in this test than Ebbinghaus assigns to them. Indeed, verbal memory, in the broad sense, would seem to be the chief factor in success. It gives what we term *fluency* in language. Verbal memory also means ability to carry the story as a whole, and therefore to see the connections in meaning running through it.

Something depends on the degree of acquaintance with this sort of literature, and perhaps still more upon peculiarities of language development in the subject. Greater originality and less imitation displayed by the subject in language acquisition will mean a poorer showing in this test, all else being equal. The method, also, of going about the task influences the final result to an important degree. The rational way is to look first over the entire story to get a conception of the whole. This was the method adopted by those who did best. In fact several of group II did not even rise to a conception of the fact that the text as a whole must make sense. These filled the blanks in just the order they were come upon and the result was either complete non-sense or else a series of phrases and clauses making fair sense within themselves but not connected with each other.

4. *Spelling*. Two lists of 50 words each were given to the

subjects on different days to be spelled. I pronounced the word, the subject writing it. Misspelled words in the other written exercises were also marked. From all the data thus obtained our subjects rank as follows, on a scale of five.

GROUP I.

A	B	C	D	E	F	G
2	1	2	3	3	1	1

GROUP II.

H	I	J	K	L	M	N
5	3	4	5	3	5	5

The reader may be inclined to have little regard for spelling as a test for mental ability, on the ground that ability to spell depends on the more 'or less fortuitous formation of certain restricted habits of observation and word analysis, habits not so very essential to good speaking or reading. There is no doubt a certain amount of truth in this contention. From observation, however, I believe that this is more often true of adults well on in life than of school children. That is, adults are likely to forget their spelling in proportion as their attention gravitates toward larger and more vital interests. A well known American scientist of undoubted genius confesses that he has lost to a considerable degree his ability to spell common English words. His students readily perceive in him a similar lack of attention to details of any sort that are regarded as formal or trivial. And yet this same man has an astonishing command over detailed and curious information of other kinds, especially of whatever happens to have significance for his scientific theories.

As another instance, I am acquainted with a man who is recognized in his community as possessed of more than ordinary business ability. As a youth he taught a country school, and I have learned from reliable sources that in the old-fashioned spelling matches he was noted for his ability to "stand the floor." At present he misspells all but the commonest words. He has no fixed way of writing a word, but employs any thinkable combination of letters that will represent the proper sound. In handling concepts of business import he has neglected the to him trivial art of spelling and so has lost it, just as many an able college president has forgotten his Latin or Greek paradigms. Without disputing that intellectual ability is often more or less one sided, I still seriously doubt whether there are many boys and girls whom we can in any sense regard as extraordinarily intelligent who with honest application could not learn to spell tolerably well. With regard to my subjects, I believe the

differences in their ability to spell are significant. Unlike the scientist and business man mentioned above, they have been compelled in their daily school work to pay heed to their spelling, and this is true to approximately the same degree of all the subjects. Moreover, they have not yet reached the age when abstractions have replaced formal observation, when microscopic vision has become telescopic.

5. *Power of Expression.* It is rather difficult to state clearly what is included under this term and yet the idea is fairly definite. The grading was done very much as one would grade ordinary school compositions, except that nothing was allowed for penmanship, neatness, spelling, punctuation,' etc. Among other factors are fluency, coherency, richness of vocabulary, spontaneity and readiness of speech, correctness of grammatical construction, sentence structure, directness or awkwardness of expression, etc. With such a variety of items contributing to the total result, the grading can be nothing more than approximate. It is valuable, however, as indicating the exceptional subjects.

After a great deal of careful consideration both of their conversational language and of the written work which they did in other tests I arrived at the following grades. It is to be regretted that data were not secured such as would have made it possible for this ranking to be made by several others besides myself. The same is true of some of the other rankings.

GROUP I.

A	B	C	D	E	F	G
2	1	1	2	4	2	1

GROUP II.

H	I	J	K	L	M	N
5	3	3	4	2	3	3

The two most striking facts are the low position of *E* and the relatively high position of *L;* *H* is also lower than in the previous tests.

I have tried to characterize in a word or two the salient points for each subject. *A.* Fluent, wordy, awkward turns in expression, well connected. *B.* Clear, logical, coherent, words well chosen, beautiful style. *C.* Very fluent, bookish tone, rather flamboyant. *D.* Fair, but not striking. *E.* Sentences run together by *ands*, many words omitted, very incoherent and broken, hazy in meaning. *F.* Clear, brief, to the point. *G.* Logical, exact, careful. *H.* Hazy, indefinite, sentences connected by *ands*, many omissions of words, parts sound like non-sense phrases strung together. *I.* Fairly good, nothing

striking. *J.* Separate sentences fairly good, but they do not follow one another naturally, a certain stiffness. *K.* Awkward, many *ands*. *L.* Fluent, marked tendency to use of big words, plainly ahead of his group in power of expression. *M.* Stiff and forced style, lacks fluency. *N.* A certain glibness, but childish in his manner of expression and in the frequent repetitions.

6. *Execution of commands.* A good indication of one's mastery of language is the ability to understand and carry out complicated verbal directions. It is commonly recognized as a sign of stupidity for one to blunder in trying to execute simple commands. A child can seldom be depended on to do a thing according to instructions, however unequivocal, apparently, the instructions may be. For the undeveloped mind such directions are little more than a jumbled mass of familiar sounds, the separate parts probably arousing the appropriate images, but the whole not comprehended in its logical significance.

To test this sort of language mastery thirty separate commands were given, orally, for moving chess men on a chess board.

The following are examples of the commands:

1. White. Move the king's pawn two steps.
2. Black. The same.
3. White. Move the king's bishop to his queen's bishop's fourth square.
4. Black. The same.
5. White. Move the queen's bishop's pawn one step.
6. Black. Move the queen's knight to his bishop's third square, etc.

This test was given after the chess practice to be described below (Section VIII) and none of the directions involved any points that the subjects were not familiar with. Important differences came out. The subjects of group I, as a rule, went to work to execute the command without question or much hesitation, while those of group II on hearing the command frequently looked up with blank face and some such expression as "What do you mean?" "I don't know what you want me to do!" "Show me," etc. The table gives the chief results.

TABLE VII.

Execution of commands.

	Rank	Average time in seconds per move.	Number of errors.	REMARKS.
A	3	11	8	Corrected all his errors. Five moves under one second.

TABLE VII.—*Continued.*

	Rank	Average time in seconds per move.	Number of errors.	REMARKS.
B	1	5	2	All but two of his moves under eight seconds. Very little difficulty. Nine moves under one second.
C	2	4	7	Very quick, impulsive, some of his errors evidently due to this.
D	3	6	10	Repeats the instructions in a whisper, moves quickly, later corrects, six under one second.
E	2	6	8	Eight under one second. Had to be showed one move.
F	4	12	11	Failed on four moves, five under one second.
G	2	6	6	Very little difficulty. Eight under one second.
H	5	13	20	Asked that several commands be repeated. Failed on five, five under one second.
I	5	16	15	Asked several repetitions, failed on four, one under one second.
J	4	13	15	Two repetitions, three failures, four under one second.
K	5	14	17	Five failures, one repetition, one under one second.
L	3	12	18	Two failures. Those he can understand at all he executes at once. Two repetitions, seven under one second.
M	5	21	17	Six failures, two under one second. Whispers over directions two or three times slowly.
N	4	11	13	Asked repetition four times. Three failures, one under one second, most of moves quickly made.

The table on page 352 gives the grades for all of the language tests.

VII. INTERPRETATION OF FABLES.

E. J. Swift (20) suggests that a subject's reaction to a complex situation is a better test of his intelligence than are the methods usually employed. Dr. Swift proposed three "situations" and the pupils of several schoolrooms were allowed to write what they thought of each: 1st, concerning the boy who put his hand into a jar to take out some nuts and grasped so many that he could not withdraw his hand. 2nd, the story of the soldier who in time of peace neglected to care for the horse that in war had served him faithfully. On the return of

TABLE VIII.

Grades and Ranking based on the Mastery of Language.

	Reading.	Word making.	Eagle Blanks.	Mole Blanks.	Spelling.	Expression.	Execution of oral commands.	Composite Ranking.
A	2	2	4	2	2	2	3	6
B	1	1	1	1	1	1	1	1
C	1	3	2	1	2	1	2	3
D	2	3	2	1	2	2	3	4
E	3	4	3	2	3	4	2	8
F	2	3	2	1	1	2	4	4
G	1	2	1	1	1	1	2	2
H	4	5	5	5	5	5	5	14
I	3	4	5	4	3	3	5	10
J	4	4	4	3	4	3	4	9
K	4	4	5	3	5	4	5	12
L	3	1	3	2	3	2	3	6
M	4	5	5	5	5	3	5	13
N	5	4	3	3	5	3	4	10

war the famished horse gave way under the weight of his rider. 3rd, Pestalozzi's fable of the Fish and the Pike. The fish were being eaten by the pike and brought suit against the latter. The judge, a pike, decided that he would mend matters by allowing two fish to become pike every day.

A comparison was made by Dr. Swift between the papers of his "brightest" and "dullest" subjects, with the result that he found no superiority on either side.

In order to give a further trial to this sort of test I allowed my subjects to give their interpretation to twelve fables which I selected after examining several hundred. I took each subject alone, read to him a fable, and then asked him to state orally what he thought it meant. The answers were therefore spontaneous and lacked the stilted and unnatural tone so common in the written exercises of the school. I cannot take space to repeat the fables here in full, but the substance of each is given below:

1. The fate of the stork which was caught in a trap set for cranes and was compelled to die along with the cranes. 2. The monkey that by use of flattery coaxed the cat to rake the master's chestnuts from the hot ashes. 3. The wolf that hired a crane to relieve him of a bone fast in his throat. After the work was done the wolf refused the promised pay and said that the crane had been paid by not having his head bitten off. 4. The girl who carried her milk to market and while calculating the eggs she could buy, the chicks she could produce from them, etc., tossed her head proudly and let fall the milk.

5. The camel that begged his master for room in the tent and then forced his master out. 6. The miller and his son who took their ass to town to sell. They walked, rode, or carried him just as people suggested until finally the animal fell into the river. 7. The foolish sheep who, at the request of the wolves, sent away the dogs that guarded them and so fell prey to their enemies. 8. The dispute between the wind and the sun as to who was the stronger. They decided by seeing which one could first make the traveller remove his coat. 9. The tortoise that begged the eagle to teach her to fly. The eagle bore her aloft and let her fall to earth. 10. The jackdaw that painted himself white and tried to live with the doves. After expulsion from their company his own mates refused to take him in. 11. The frog who tied the mouse to his leg by a string and then jumped into the water. As the drowned mouse floated on the surface it was seized by a hawk, who carried it away together with the frog and devoured both. 12. The maids who killed the cock which woke their mistress so early. No longer able to tell the time of night the mistress aroused her maids earlier than ever.

Finally, in order to secure results that could be compared to Dr. Swift's, I proposed to my subjects the same three stories that he used. We have therefore fifteen separate tests of this sort; a number sufficient to carry us beyond accidental variations in the quality of the answers. A subject will now or then do better or worse than we expect, but on the whole his level of efficiency in this kind of work can be estimated with a good deal of accuracy from a sufficient number of trials. The following are examples of the replies precisely as given by word of mouth, except for a few abbreviations. A casual glance will reveal significant and characteristic differences between the two groups. The poorest answers are italicised.

The Storks and the Cranes. *A.* To beware of taking other people's property. *B.* To think out what we do before we do it. *C.* That if you are caught with wrong things, they'll do the same with you as if you were bad. *D.* It means that if he was caught with them, he would have to die with them. *E.* Teaches us to keep away from bad company. *F.* Teaches us not to be caught with bad people. *G.* One is just as bad as the other if they steal. Don't know what it teaches. *H. Lesson is that it learns us to catch cranes and storks.* *I. It teaches us how to catch birds.* *J. Teaches us that cranes eat corn.* *K.* It means that — the cranes not to come and eat the grain again, and they lose their life for a little bit of grain. *L.* Don't know. *M. Not to go in those traps.* *N.* Teaches not to be with the birds that took the stuff.

The girl and her milk. *A.* Teaches us not to be too proud and not to say anything before you do it. *B.* Not to plan ahead too far. *C.* Not to make your plans until you've got something to make them with, and don't be too sure that they will work. *D.* She was too proud. She ought not to have counted her chickens before they were hatched. *E.* Not to count your chickens before they are hatched. *F.* She felt proud. Teaches us not to be too proud. *G.* Don't count your chickens before they are hatched. *H.* Learns her a lesson not to talk about anything before she gets it, and *not to carry a pail on her head.* *I. To not be too gay when you have anything, you might lose it.* *J.* Not to be too proud. When you be proud why everything goes back

on you. *K.* Warns you not to be too proud. She thought that she was going to get so much and she got left. *L.* Not to be too proud. *M. Not to think we are so big.* *N.* Same as that she had n't ought to count her chickens before they were hatched.

The Arab and his camel. *A.* Not to let people do too much or they might do the same as the camel did. *B.* Don't know. The Arab ought not have let the camel in at all. *C.* When you get small things, don't ask for big things and don't put everybody else out. *D.* It was a greedy camel and teaches that the Arab had n't ought to let him in. *E.* The Arab knew that the camel was big and the tent was small. He ought to just let him put his head and neck in. *F.* Teaches us not to divide too much. *G.* Teaches us not be too good to selfish people. *H. Learns a lesson to the Arab not to stay in his tent with the camel again.* *I. To give poor people things and not the rich.* (Why?) Because he let the camel in and got out himself. *J.* Not to let anybody in when you think the place too small. *K.* Teaches the man not to let anything into his house again. He will get put out instead of the camel. *L. The camel thought he'd make the Arab go out there too as long as he kept his poor camel out. The camel was foxier than what he was.* *M.* Not to be selfish. The camel was selfish and wanted all the tent. *N.* That the Arab had n't ought to a been so foolish. Had n't ought to a let the camel have so much room.

The Miller, his boy and the ass. *A. To care for others, not for yourself.* The farmer did n't care for himself, he cared for his boy and ass. *B.* Not to pay any attention to other people. *C.* That if you try to please everybody, you won't please anybody and you will get into trouble yourself. *D.* They tried to please everybody and pleased nobody. *E.* That they had n't ought to mind every one. *F.* Teaches us not to try to please other people. *G.* Don't take everybody's advice. *H. Learns them a lesson not to carry a donkey across the bridge, or carry them any place.* *I. It means to help the old people instead of the young.* *J. Not to try to carry anything that is too heavy—A thing that kicks and everything.* *K.* Teaches the man not to mind what anybody else says. *L.* They thought they would sell the donkey, and before they got there the donkey fell into the river. *It teaches us not to think it till we are sure.* *M.* The miller wanted to do just as people told him to do. (Ought we?) Not always. *N.* They tried to please everybody and could not please themselves.

The Jackdaw and the doves. *A.* It means not to try to get into another company when you belong to one, or you might miss both. *B.* We should be contented with what we are. *C.* When you are one thing don't try to be something else. *D.* That the Jackdaw ought to have been contented with what he had. *E.* He was too proud of himself. He wanted to cut out every one else, and got caught. *F.* Not to try to look like others. *G.* You must not try to get what does not belong to you. *H. Learns us a lesson not to paint ourselves white and try to go into some other family.* *I.* Not to try to get into other company. *J. Not to do anything, paint yourself or anything, if you ain't a dove, or else you will never get back.* *K.* The Jackdaw wanted too much. It teaches him not to go to anybody else's place to get food. *L. That if he wanted to belong to the dove cote he ought to a kept still.* He wanted to belong to both companies, but by being a little bit fresh he could n't. *M.* Not to try to do what you can't do. *N.* Not to try to be somebody else. He ought to have lived the way he was always living.

The frog and the mouse. *A.* Not to be unkind or you'll get into trouble. *B.* To show kindness to our neighbors. *C.* Shows how

foolish the mouse was to try to do something she knew she could not. *D.* The frog had so much pride and thought he 'd harm the mouse, and after he did he got harmed more. *E.* Teaches not to be too kind like the mouse was. *F.* Teaches you not to be unkind to people. *G.* To do to others as they have done to you, because the mouse had showed him everything and did not hurt him. *H.* Learns a lesson to the mouse not to go in the water for he can't swim; *and learns the frog not to tie a piece of grass to his leg and the mouse's leg. I.* Not to take anybody else in a bad place. *J. Teaches you not to go if you think you can't swim. K.* (Omitted by mistake.) *L.* Teaches us not to be silly like the frog. *M.* Not to be foolish. *N.* The mouse was foolish. He might know he would get drowned if he went in the water.

The maids and the cock. A. Not to work your children too hard. B. That we ought not to try to disarrange any one else's plans. *C.* That the little maidens had not ought to a killed the cock without their mother's advice. *D.* Teaches that they ought to have left the cock alone and they would have been all right. *E.* Teaches us not to do anything wrong. *F.* Not to do wrong. *G.* Don't know. *H.* Learns a lesson not to kill a cock when he wakes them up early in the morning and so they can't tell what time it is. *Teaches us not to kill a cock. I. Not to give any little person any hard work. J. Not to kill anything else you 'll get woke up just the same. K.* (Omitted by mistake.) *L.* Not to be so silly like the maids and kill the cock, for the cock was not to blame. *M.* Teaches the girls not to be lazy. *N.* That they ought to have been satisfied with getting up when the cock crowed instead of getting up in the middle of the night.

The fishes and the pike. A. I think the judge ought to a done something to the pike. (Fair?) No.—Fair in one way though, to let the little fish become pike, but he ought to a punished the pike. *B.* Not fair. (Why?) Because the more pike there became, the faster they would eat the little fish. *C. It might be better for the little fish in some ways,—they would not be eaten up.* It would be bad for the pikes because they would have nothing to eat. *D.* That was all right, but then if only two are changed to pike the others would get eaten up. *E.* While the two fish are changing into pike the rest of the little fish would get eaten up by them. *F.* (Omitted by mistake.) *G.* It was all right, but it was kind of funny that they didn't do anything to the pike. *H.* It will learn the little fish to keep away from the pikes. (Good or bad decision?) *Bad cause they were gittin turned into pikes. I. Good decision, because the little fish was turning into big ones and the big fish wouldn't dare to eat them now. J. The judge was kind enough to let them be a pike. K. He ought to let all the fish be pike if he was going to let two, cause the other little fish was as good as the two. L. Fair decision, for two would be turned to pike every day and not be eaten up. M.* If the pike could eat up all the little ones in a day it would not be a good decision. *N.* Don't know. He ought to a stopped the pike from eating up the little fishes.

Group II show two chief points of inferiority. In the first place, they more frequently miss the point of the story altogether. For example, *H* and *I* think that fable 1 teaches us how to catch birds. *J* thinks it teaches that cranes eat corn. In 5, *I* thought that the Arab got out of the tent of his own accord as an act of charity. *H* and *J* interpreted fable 6 as a warning against carrying a donkey or *anything else that kicks! I* thinks it teaches respect for old age. In answer to 15, *H*

thought it was bad for the little fish to be turned into pike. *I*, *J*, and *L* thought it was very kind of the judge to change them into pike. From such replies it is evident that, as a whole, group II are unable to appreciate fine shades of meaning. They know in a general way what is being talked about, but they fail to comprehend much that to us seems clearly expressed. In fables, moreover, a good deal is frequently left to be inferred by the reader, and here always the dull subject is at a disadvantage. He cannot supply the meanings hinted at because he is insensible to the thought fringes. It is these that must give meaning to the fable; the dullest subject is apparently able to image the objects and activities described, but taken in the rough such imagery gets him no whither. They are like pieces of scrap iron that need welding to be of value.

In the second place the dull boys are plainly deficient in degree of abstraction. Even when they give an approximately correct interpretation they usually express it in the concrete terms of the given situation, instead of generalizing it. For example, *H* thinks fable 5 "learns the Arab not to stay in his tent with the camel again." In 10, *H* answers "learns us a lesson not to paint ourselves white and try to go into some other family." *J* "not to do anything, paint yourself white or anything, if you aint a dove, or else you will never get back." In 11, *H* sees only a warning to the frog never again to fasten a mouse's leg to his own with a piece of grass. *K* answers 14 thus: "It teaches the man when he has a horse to keep it and use it well." *M*, "the soldier ought to have fed him just the same when he did n't go to war." *L* replies to 2, "Its just like if you was stealing apples, and you steal them and another fellow eats them." 9, *H* "learns the tortoise not to fly when he ain't got any wings."

The better subjects answer nearly always in general terms and *N* of the stupid group did also, probably because of his advantage in age.

This last suggests that what is tested by the interpetation of fables is in part at least that general change of mental horizon that comes with increased experience and dawning maturity. But as mental deficiency is itself in many respects a sort of continued infantilism, this is, perhaps, not so much a point of criticism as of commendation.

My results with this test show such clear differences between the bright and dull groups that I cannot but think the method employed by Dr. Swift in making his tests somewhere at fault. I should judge that his results would have been different if he had been able to take his cases individually instead of collectively.

The grades as I have estimated them for the tests with the fables are given in the following table.

TABLE IX.

Grades and Ranking based on the Interpretation of Fables.

Fables.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Rank.
A	4	4	2	3	1	5	4	4	5	2	2	2	1	3	4	8
B	4	3	3		3	1	2	4	1	1	2	2	1	3	1	1
C	1	2	3	1	2	1	4	5	1	1	2	4	1	3	5	2
D	2	4	4	2	3	1	3	4	4	1	4	4	2	4	3	6
E	1	4	2	1	1	1	5	4	4	4	4	2	1	3	2	4
F	1	4	5	4	1	1	4		4	2	3	2				6
G	4	2		1	1	1	1	4	1	3	3		2	3	2	3
H	5	5	5	4	4	5	4	5	4	3	4	5	4	5	5	14
I	5	5	5	4	5	5	5	4	1	1	4	4	1	4	5	9
J	5	4	2	4	3	5	4	4	4	5	5	5	1	5	5	11
K	5	4	4	4	4	1	4	5	4	5			2	4	3	10
L		3	5	4	5	5	4		2	5		4	1	4	5	13
M	5		4	4	3	2	4		5	5	3	5	1	5	3	10
N	1	1	2	1	3	1	3	4	3	1	4	4	3	5	3	5

VIII. LEARNING TO PLAY CHESS.

A complex game, such as chess or checkers, undoubtedly makes extensive demands on intelligence. This statement is not contradicted by the fact that many expert players have accomplished little in the useful arts or sciences. They have probably lacked certain emotional and volitional qualities, making it impossible for them to apply their intellectual powers to other work. For example, it is obvious that the constructive imagination necessary for chess plays also a part in the success of the military strategist, while the moral and volitional qualities may be much more dissimilar. It is more likely the rarity of a suitable combination of the latter that accounts for the fewness of great military strategists, rather than the rarity of sufficient intellectual ability.

I intended to use checker-playing as a test, but finding that several knew something of the game, I gave chess instead. For three weeks, or about eight to ten hours in all, the subjects played in pairs, the bright against the dull. I watched the game and took extensive notes but did not record the separate moves. My judgment is, therefore, somewhat subjective, but the main differences are so evident that one could hardly mistake them.

The following table gives the chief facts. By "error" is meant moving a piece in some other way than is allowed by the rules. Ability to plan is graded on a scale of five. It should be explained that before beginning the playing I demonstrated all the main points of the game and also all the possible moves of each piece. This was repeated twice and the subject's questions were answered.

TABLE X.

Grading on Learning to Play Chess.

	Errors in 1st 100 moves.	Errors in 2nd 100 moves.	Rank on errors.	Grade on ability to plan.	GENERAL.
A	13	5	6	3	Several errors, poor defense, follows up a plan to neglect of rest of board, many "give-aways," quick.
B	2	0	1	1	Almost total absence of errors, by far the best player in all respects, never moves blindly, quick to grasp the situation and move.
C	1	2	2	2	Very few errors, effective planning, intermittent attention, and numerous motor automatisms. Nervously quick.
D	5	1	3	3	Few errors, occasional tendency toward aboulia, lack of sustained attention, and little plan, generally quick.
E	19	5	7	3	Relatively numerous errors, lack of sustained attention, general ineffectiveness due to a happy-go-lucky way of moving, quick.
F	7	1	5	3	Few errors, not very steady attention, short sighted, but deals fairly well with the immediate situation, quick.
G	7	0	4	2	Few errors, general ability to plan good attention, and quickness.
H	26	14	11	3	Many errors, readiness to capture and to defend pieces from immediate danger, ability to plan good as compared to errors, attentive, fairly quick. Has played checkers.
I	16	10	8	4	Numerous errors, overlooks capture, many "give-aways," general lack of plan, apparently attentive, fairly quick.
J	28	11	10	4	Numerous errors, vagueness of plan, inability to attend to more than one part of the board at once, absent-minded, fairly quick.
K	28	20	12	5	Many errors, many "give-aways," and general lack of plan. Slow.
L	23	15	9	4	Many errors, little plan, many "give-aways," good attention. Slow.
M	29	21	13	5	Very numerous errors, complete lack of offensive, over cautious, good attention, extremely slow, poorest player.
N	38	27	14	4	Frequent errors continued to the last. General lack of plan, attention not very steady, overlooks captures, many "give-aways." Slow.

A. Errors rather numerous at first but gradually eliminated. Played 16 games with *H* and won 6. Moves rapidly; median time about 3 seconds. Talks much about the progress of the game. Personifies the pieces. Plans ahead but neglects defense. Continually moves out pawns unsupported. Captures without noting result. The following notes, taken in 12th game, are typical: gives pawn to pawn; exposes bishop to castle, tries to trade knight for bishop; gives pawn to pawn; castle to pawn; bishop to queen; and queen to pawn.

B. No error after first game. Won 14 out of 15 with *L*, and 1 out of 2 with *C*. Median time per move less than 2 seconds. Showed curiosity about the rules and the purpose of the game. Seldom overlooks capture, not a move made blindly, laughs over the effect of bad moves, often asks whether I see his plan, guards king well, almost no "give-aways," usually wins from *L* with loss of only 2 or 3 pieces, talks to me while opponent studies his move. Not to be compared with any other players except *G* and *C*, and is far better than they are.

C. Very few errors. Won all of 12 games with *K*, and 1 of 2 with *B*. Nervously quick in moving. Median time less than 2 seconds. Does not attend to his plays half the time. Often stops to explain the outcome of different possible moves. Second only to *B*. Always plans ahead. Overlooks almost no captures. Has good ideas about the relative value of pieces. His showing injured by occasional inattention. Many motor automatisms while playing. (See section XI, below.)

D. Few errors. Won all of 12 games with *M*. Generally moves very quickly, but occasionally studies 5 to 10 minutes. On such occasions shows a tendency toward *aboulia* in his inability to decide what move to make. Fingers his pieces about, retracts moves, argues the advantages of different possible moves, and is unable to decide between alternatives. It does no good for me to hurry him; he wants to move quickly, but simply cannot. Perhaps his most striking trait is lack of sustained attention. Attends to other things while his opponent is moving. At his turn he gives a quick glance at the board and unless under a spell of *aboulia* moves without delay. Even when unable to move for several minutes, he does not study the board a third of the time. He touches different pieces, discusses moves, then talks of something, or even gets up and walks about, all the time keeping up a series of indescribable automatisms. Overlooks few captures, but shows little plan; overguards king and uses only a few pieces for the offense.

E. Worst of bright group on errors, but gradually left them off. Won 13 out of 17 games with *J*, and 2 out of 5 with *F*. Moves quickly, generally in less than 2 seconds. Seems careless and inattentive, as in all his work. Studies the board less than half the time. Sometimes, however, devotes a few seconds to working out an effective plan. Talks much about the plays. Quick to accept captures, but shows little initiative. Rather numerous "give-aways."

F. Few errors and these soon left off. Won three games out of 5 with *E* and 12 out of 14 with *I*. Moves rapidly at first, later is more cautious. Talks much about the progress of the game, but really studies the board very little. Looks about and talks with me. Lacks definite plan, but handles the immediate situation to fairly good advantage. Few "give-aways," accepts captures and makes use of all his pieces.

G. Very few errors. Won 16 out of 17 games with his older brother, *N*. Few moves take more than two seconds. Attentive, likes the game. Always plans ahead, seldom overlooks captures, few "give-aways." At first, overguards king, but later corrects the fault. Soon

learns to take advantage of the fact that his opponent overlooks many captures, and so in order to locate his pieces where he wants them he exposes them to attack. Regularly makes use of all the pieces.

H. Many more errors than the poorest of the bright group. The knight, bishop, and castle were wrongly moved to the last. Won 10 out of 16 games with *A*. Moves rapidly, seldom overlooks captures, few give-aways, good deal of plan. Overguards the king, using only bishop and castle for attacking. Makes captures to neglect of the real end of the game. His rank on plan is rather surprising, considering his many errors. This probably due to his having played checkers a great deal.

I. Many errors. All the pieces wrongly moved to the last, but knight the worst offender. Won 2 out of 14 games with *F*. Extremely little plan; avoids only slightest difficulties: overlooks about half his opportunities to capture; overguards king; little conception of the relative value of the pieces: makes no use of his knight nor does he defend himself from his opponent's knight. For example, in the 12th game, gives pawn to pawn, bishop to pawn, pawn to pawn, fails to take bishop with pawn, queen with queen, and overlooks the fact that his opponent's king is in check. After being beaten several times he came to dislike the game.

J. Made errors with all the pieces to the last game. Won 4 out of 17 with *E*. Moved quickly, except now and then when listless or absent-minded. Sometimes forgot his turn to move. Makes plans but cannot execute them. Exposes his pieces to capture while working out a scheme. Never moves knight without hesitating and counting spots. In last game exposes knight to pawn, bishop to castle, castle to knight, castle to bishop, fails to take pawn with pawn, gives pawn to pawn, and captures his own piece. Fights mostly with a bishop and castle.

K. Many errors, pretty evenly scattered among the pieces. Lost all of 12 games to *C*. Moves slowly; little plan; captures without looking to the result; many "give-aways." For example, in the 10th game, trades castle for pawn, moves up pawn alone and loses it, gives castle to pawn, pawn to pawn, knight to castle, pawn to pawn and trades bishop for pawn.

L. A majority of the errors due to confusing the bishop and castle. Out of 15 games with *B*, lost all but 1. Deliberate, sometimes studying a move for two or three minutes. Watches the board intently and says nothing during the game. Little plan. Habitually runs a pawn clear across the board alone to be captured. Three times moves king out toward the centre of the board alone. Gives many pieces away, but seldom fails to take captures offered. In game 13, gives pawn to pawn, castle to pawn, pawn to pawn, knight to pawn, trades queen for bishop, fails to take bishop with knight, exposes castle to pawn, and king to pawn. Knight little used, and the bishop and castle so confused as to be nearly worthless.

M. Worst subject on errors. No piece was fully learned. Won none out of 12 games with *D*. Exasperatingly slow. Median time about 1½ minutes, and often studied a move 5 minutes. Very attentive, never looking up except to ask how to move a piece. Foresees only the immediate result of his moves. Accomplishes nothing in attack. Devotes all his attention to preventing loss of pieces. Bunches nearly all around the king and moves back and forth with only one piece.

N Never sure of the move of any piece. In last two games, makes the following errors: Moves pawn angularly twice; captures with pawn by moving straight forward; moves knight wrongly seven times;

castle forgotten three times; king too far once; four times makes turns with other pieces than the knight; and castles wrongly. These worse than some of the preceding games, probably because of decreasing interest. Rather slow. Lost 16 of 17 games with his younger brother, *G.* Avoids some losses, but little plan; a vague idea of what to do, but no definite idea of how to carry it out. Many "give-aways," often losing an important piece to a pawn. More intent on accepting pieces offered him than on creating new situations. Did not guard king till told by opponent to do so. On being checkmated is usually surprised and asks how it was done.

With regard to chess as a test of intelligence I may say that it clearly differentiates the two groups, and that so many interesting things came out that I regret not having had more time to devote to it. I should like the opportunity to choose two or three pairs of my subjects and observe them daily in chess or checkers for several months. I believe that the insight gained would amply repay the time expended.

IX. Memory.

Memory tests have been in the past rather unsatisfactory. It is practically impossible to get at the pure physiological retentiveness, while if we aim at testing the everyday working memory our results are still more disturbed by interests and habits of apperception. Memory in any case, considered as pure physiological retentiveness, would seem to be of no more than intermediate importance in a study of intellectual differences; more significant than sense differences but less so than the logical and creative processes. The great minds have more often had logical than desultory memories. There must of course be a certain minimum of physiological memory, as distinguished from the apperceptual, in order to make possible a distinctively human intelligence, but above this minimum limit we may have almost all grades of intellectuality according to the manner in which the atoms of experience are united by interest, association and meaning. A desultory memory can give us only the crude materials for genius. It is not till these fragments have lost their separate identity by coalescence into a whole,—by assuming a net-work of relations to one another—that intelligence emerges. So many different lines, of such varying degrees of importance, are open to habits of apperception that with a given amount of plasticity many grades of intelligence are possible. It may give us on the one hand an ignorant hotel attendant, with a memory that enables him to return to each of a hundred guests his own hat, or, on the other hand, a Humboldt, with a tenacious memory for the facts of science but unable (according to his own confession) to quote *verbatim* a single line of literature, either poetry or prose. It is mostly the character of the synthetic operations, combined

with emotional and volitional qualities, that distinguishes the two minds. This is little more than to say that memory for the most part is particular rather than general, though there are a few minds that are encyclopædic and retain with little discrimination. For these and other reasons I do not regard my memory tests as of so very great importance. They are as follows:

1. Ability to reproduce a complex geometrical diagram. For this purpose I employed the diagram used by Binet in his own experiments on memory. The purpose of the experiment was explained to the subject and after one minute's exposure of the figure he was allowed to reproduce it, erasing and redrawing until satisfied.

2. Chess moves; see grading on errors, Table X above.

3. Reproduction in writing of a story heard. The story used was about 300 words long. This was a group experiment.

4. Same with another story about twice as long.

5. Oral reproduction of a story read. The subject was given five minutes in which to read and study the selection and then give it orally while I took down his words. This plan was followed to avoid the disinclination that some of the subjects seemed to have for writing. Greater spontaneity was also secured. The story was an interesting Indian legend about 200 words long.

6. Same with another story of about 500 words.

7. Ability to repeat the solution of a simple mechanical puzzle after watching its performance by another. The puzzle consisted of two iron links so made that they could be separated only by being turned in a certain way. My method was to hold the puzzle before the eyes of the subject and after soliciting his attention perform the separation myself slowly by three successive stages. He was urged to look closely and to remember the positions of the pieces in each stage of the solution. If he was then not able to make the separation himself within one minute I showed him again, and so on until the trick was perfectly learned. It is evident that after the first success the memory is partly a motor one, and even previous to such success the visual images may be retained partly through motor associations.

The following table shows the grading for each memory test on a scale of five. The mechanical puzzle gives results at so great variance with the other tests that I have not included it in making the composite ranking.

TABLE XI.
Grading and Ranking on Memory Tests.

	Binet's figure.	Chess moves.	First story heard.	Second story heard.	First story read.	Second story read.	Mechanical puzzle.	Composite ranking on memory
A	4	3	3	3	4	3	3	6
B	3	1	1	2	1	2	2	3
C	2	1	2	2	1	1	1	2
D	2	2	3	3	2	3	5	4
E	3	3	4	4	4	5	5	10
F	5	2	3	2	2	3	1	5
G	1	2	1	1	1	2	3	1
H	5	4	5	5	4	4	1	14
I	4	3	5	5	3	5	2	13
J	5	4	4	4	3	4	3	11
K	3	4	5	4	3	3	2	9
L	4	4	2	3	3	4	2	6
M	3	5	3	4	5	4		11
N	5	5	4	2	3	2	4	8

CHAPTER X. MOTOR ABILITY.

The theory that all mental traits tend to express themselves physically has long been held in one form or another. The moralist has always been reluctant to credit one with the possession of ethical qualities which never give direction to behavior, while recent psychology, with its experiments on muscle reading and its automatographic tracings, teaches that every idea is motor. Neurologists believe that motor activities have a reflex effect on all the functioning of the brain, and the salutary effects of manual training on intelligence give a basis for the theory. Bolton believes that the ability to take on new motor habits represents educability, and that the motor practice curve furnishes a reliable test of mental weakness. (2). Several attempts have been made to correlate intelligence with motor accuracy, rapidity, strength, etc., but with contradictory results. Kirkpatrick finds a positive correlation. Bagley a negative one. Havelock Ellis finds that British men of genius often show marked awkwardness of bodily control. Gesell finds a direct relation between mental ability as judged by the teacher and skill in handwriting. My own subjects are too few and my motor tests not adapted to the working out of mathematical correlations.

1. *The practice curve.* This was the most important motor test tried. The apparatus was a small wooden cup about two inches in diameter set on a wooden handle eight inches long.

At the middle of the handle was attached a string two feet in length, and to the end of the string was a wooden ball of the proper size to fit easily into the cup. The subject grasped the handle, gave the ball a swing upward and tried to catch it in the cup as it fell. Several elements enter into the success. 1. It is a test of visual-motor co-ordination. 2. Much depends upon motor memory, which in turn involves sense discrimination in the field of the "muscle" sense. 3. The higher processes are involved, inasmuch as there are certain points of method to be learned which make the catch much more certain. 4. Attention.

Each subject was given 40 trials with each hand at each visit to the laboratory until 2,000 trials were made, 1,000 for each hand. The method employed was to give 20 with the right hand, then 20 with the left, etc. The visits to the laboratory were not entirely regular, but for the most part were made every other day. The results were reckoned upon the following basis: A catch was scored as 0. If the ball dropped into the cup, but in such a way as to bound out again, the score 1 was given. If the ball simply struck the cup on the side or rim but did not drop in, the score was 2. A complete miss

TABLE XII.

Grading and Ranking on Motor Skill with the Cup and Ball.

	Average daily score for first 8 days. Right Hand.	Rank for Right Hand.	Percentage of inferiority of Left Hand.	Average daily score for second 8 days. Right Hand.	Rank for Right Hand.	Percentage of gain over first 8 days.	Percentage of inferiority of Left Hand.	Average daily score for last 9 days. Right Hand.	Rank for Right Hand.	Percentage of gain over first 8 days.	Percentage of inferiority of Left Hand.	Final Rank on score.	Final Rank on degree of inferiority of Left Hand.
A	24	14	—12.5	50	13	108	1.5	54	13	125	14.8	13	13
B	58	12	3.1	71	12	22.4	—9.6	86	9	48.2	9.3	12	14
C	62	10	9.7	74	10	19.3	10.8	75	10	20.9	12.	11	8
D	26	13	26.9	41	14	57.7	48.7	48	14	84.6	50.	14	1
E	59	11	15.3	75	9	27.1	6.6	88	8	49.1	11.3	10	7
F	78	3	6.4	99	1	27.	3.1	100	2	28.2	5.	2	12
G	68	7	5.8	76	8	11.7	1.3	62	12	—8.8	—30.6	8	11
H	93	1	22.5	95	3	2.	3.1	105	1	12.9	12.3	1	4
I	74	6	21.7	88	5	18.9	1.1	91	6	22.9	6.5	5	9
J	66	9	6.	84	7	27.2	9.5	89	7	34.8	20.2	7	6
K	76	4	17.1	98	2	28.9	18.3	100	2	31.5	17.	3	2
L	90	2	12.2	90	4	0	18.8	98	4	8.8	7.1	4	5
M	68	8	17.1	87	6	27.9	20.6	93	5	36.7	9.6	6	3
N	75	5	25.3	72	11	—4.	11.1	72	11	—4	—6.9	9	9

was scored 3. These numbers were then added together, the lowest score thus giving the best record. The results for each day were kept separate. Record was also kept of the number of times the ball not only missed but was swung far behind the cup at full length of the string. In the same way records were kept of the number of swings as much too short.

The preceding table gives the chief results according to a reverse method of computation. It will be seen that Group II are, on the whole, decidedly superior in this test. *A* and *D* rank so far below all the others as to form a group by themselves. Group II also show greater superiority of the right hand over the left than do Group I. *F* is left-handed but has been taught to write with right hand. The table gives but little idea of the extreme awkwardness of *A* and *D*.

2. *The arrow and trough.* A smooth wooden trough was constructed about 10 feet long and 1 inch wide. A light, smooth wooden arrow three feet long was then made, of a size to fit easily in the trough. The test was to lay the arrow in the trough so as to project an inch and then with a wooden paddle to strike the projecting end of the arrow and drive it to a given point. In these experiments the arrow was to be driven two feet. Trials to the number of 150 were given each subject, 50 a day for three succeeding visits, all with the right hand. The chief aim was to test muscle discrimination and motor memory.

Average deviation is the most important item in the result and the rank on it for the three sets of trials combined is:

Group I.

A	B	C	D	E	F	G
10	1	14	11	12	2	9

Group II.

H	I	J	K	L	M	N
3	4	7	12	5	6	8

B, *F*, and *H* show least variation in the average deviation for the three trials. *A*, *C*, *E* and *M* show most, and the others are between. There are also wide differences in practice gain. If we rank our subjects on this point we have:

Group I.

A	B	C	D	E	F	G
2	9	1	13	4	11	14

Group II.

H	I	J	K	L	M	N
12	7	9	5	6	3	8

The lack of correlation among the three separate trials indicates that the results on this test are not very reliable.

3. In order to learn the rate of motivation for some of the larger, more fundamental muscles the subjects were given three trials at running down stairs. A continuous series of six flights of ordinary stairs in the University building served for the purpose. This test was not very satisfactory for the reason that a good deal seemed to depend on how much risk of falling the subject was willing to take. I will give only the grade on a scale of three.

GROUP I.

A	B	C	D	E	F	G
1	1	1	3	3	3	3

GROUP II.

H	I	J	K	L	M	N
1	3	2	1	1	3	2

4. *Learning rhythmic movements.* The series of movements used was a variation of those accompanying the well known words "Bean porridge hot, bean porridge cold, bean porridge in the pot nine days old." It consists of slapping the hands in changing order, either together, on the knees, or against the hands of another person sitting opposite, who goes through the same movements. Some of the subjects had learned in the past series somewhat similar but so far unlike the one used that it is doubtful whether the results were affected.

Results. The subjects fall into three groups. 1. *B*, *C*, *F*, *G*, *H*, *J* and *N* perfected the series in 4 to 5 minutes. 2. *D* and *I* in 9 to 12 minutes. 3. *A*, *E*, *K*, *L* and *M* in 15 minutes and upward.

5. *Steadiness.* The subject was given a book and told to carry it about the room on his head. Though this would seem to be a very rough test, the results are interesting. All were able to perform the feat without great difficulty except three, *A*, *D*, and *I*. *I* could seldom get farther than 20 or 30 feet without letting the book fall, and *A* and *D* not over two or three steps, the book often falling off before they could get started. It will be remembered that *A* and *D* are the subjects so far inferior to the others with the cup and ball. There was also distinct difference in the nervous strain with which the feat was accomplished. Some of the subjects walked about with a smile, the arms relaxed, and step even and regular; others with firmly set jaws, the muscles of the neck tense, the head screwed awkwardly to one side, the arms held rigidly out from the body, the fingers cramped, and with stiff, jerky gait. *B*, *F*, *G*, *H*, *J* and *L* showed the least of this overflow of muscu-

lar innervation, *A*, *D*, and *I* most, while it was quite marked, though to a less degree, with *C*, *E*, *K*, *M* and *N*.

6. *Motor Automatisms.* For a discussion of the importance of motor automatisms as an index of nervous balance the reader is referred to Lindley's study of the motor phenomena of mental effort. (11.) Two of my subjects, *C* and *D*, were quite remarkable in this respect, keeping up continual and countless contortions of body and face, singing or whistling, twitching fingers, shuffling the feet, whispering, clucking, puffing out the cheeks, trilling the lips, corrugating the brows, fingering a pencil, tapping with fingers, getting up, turning on chair, etc. *A*, and to a less degree *B*, *E*, *K* and *N*, were also subject to automatisms. Relative to motor automatisms they may be graded on a scale of five, as follows:

GROUP I.

A	B	C	D	E	F	G
3	2	4	5	2	1	1

GROUP II.

H	I	J	K	L	M	N
1	1	1	2	1	1	2

A, *C*, and *D* are the striking cases. It will also be remembered that *A* and *D* were totally unable to walk with a book balanced on the head, and were ridiculously awkward with the cup and ball; nor could they shoot marbles. *C* is a stutterer and did rather poorly with cup and ball.

On the whole, then, the advantage in motor ability, in so far as it has been observed, lies with the stupid subjects, *D* and *A* being especially deficient. My results, therefore, so far as they show anything on the correlation of mental and motor skill would agree with those of Bagley in supporting a negative correlation.

XI. Individual Sketches. A. Age, 10 years 2 months. Weight, 63 lbs. Healthy and without marked physical defects. Of American parentage, son of a carpenter. Has attended school 5½ years and is in 6th grade. His teacher describes him as poor in drawing, but good in all his other work, being specially apt in arithmetic, and delighting in the solution of complicated problems. At school, also, he shows unusual inquisitiveness and desire for explanations. In the tests he takes rather low rank in invention, very high in mathematics, and extremely low in physical dexterity. His many automatisms are noted elsewhere. His awkwardness is well nigh indescribable. Several times he fell off his chair while going through his numerous contortions. Never acquired any dexterity with the cup and ball. In the latter exercise he was not only unable to get the cup in proper position for catching the ball, but never even learned to control the force of the swing. For two or three trials the ball was swung over his shoulder at full length of the string. Then would follow two or

three attempts about as much too weak, the ball not rising enough to permit the cup to be placed under it. This same lack of motor control is seen in his inability to shoot marbles, to sing a simple tune, to learn to swim (though he tried almost every day during one summer), to learn complex movements with Indian clubs, or even to perform so apparently simple a feat as walking with a book balanced on the head. He is of lively and sunny disposition, but a little mischievous and even headstrong at times. His expression is lively, his eyes have a happy twinkle, and he often talks jocosely to himself as he works.

B. Age, 11 years 1 month. Weight, 76 lbs. Looks strong but has been ill a good deal. Hearing about ¼ normal, due to scarlet fever at the age of 7. A few months ago he underwent an operation for the removal of an adenoid. Father a successful business man of more than ordinary culture. Of American parentage and able to trace his ancestry back to an English earl of 250 years ago. Has attended school only 2½ years, and in the first of these years only about one-fourth of the time (by reason of illness). Regarded by teacher as possessing remarkable ability. She says his attention is wonderful, sometimes leading him to work until exhausted. The father also testified to the latter trait and related how when lying ill he propped himself up by pillows and covered the bed with books which were read as long as the physician allowed. Uniformly good in the mental tests. He is extremely neat, of fine bearing, cultured manners, and extraordinary command of spoken language. His experience has been broadened by travel and by acquaintance with numerous books. Has associated little with other children and has played few games. Expresses an ambition to graduate in college and university and to become a naturalist. May be described as logical and clear headed.

C. Age, 10 years 10 months. Weight, 73 lbs. Health good. Mild astigmatism and wears glasses. Of English and French descent and of fairly cultured family. In the 6th grade at school. Described by teacher as poor in spelling and arithmetic but talented in drawing and literature. Of flighty attention. This agrees with my own observations. He has quick perception but no will to work at what is not agreeable to his tastes. Of active, nervous temperament. Wants "to do things." Several times expressed dislike for mental tests and preference for the motor exercises. Slender, stutters badly, has many nervous automatisms. His teachers testify that his stuttering is much worse near the end of the school year. Has ambition to become an artist. Greatly interested also in literature and has read several novels. Once recounted to me the story of Dickens's Tale of two Cities. He told it in minute detail, and as he progressed became more and more excited, stuttered, talked rapidly, and showed great bodily agitation, standing up and then sitting down and all the time keeping up numerous automatisms. May be described as imaginative and poetical rather than logical.

D. Age, 10 years 5 months. Weight, 78 pounds. Tall and slender. Slight astigmatism and has worn glasses since he was four years old. Had an adenoid removed two years ago. Takes cold easily. Of cultured, middle-class family. In the 6th grade of school work. Gets his highest school grades in history and his lowest in numbers. Teacher notes the unusual facility with which he comprehends explanations, and his fine memory for all the school exercises. Ranks lower in the puzzles and chess than elsewhere. His attention is spontaneous and flitting. His work is done by brief strokes of attention. Often interrupts his work to talk of other things. Is quick to comprehend a witty remark, is vivacious, has very mobile facial expression. In the

physical tests he ranks lowest of all. I have not observed such a lack of motor co-ordination in any other boy. He made little progress with the cup and ball, could not shoot marbles, was slow to learn rhythmic movements, often stumbled and fell, and like *A*, could not walk with book balanced on head. His automatic twitches extend almost to the point of chorea and his frown or smile shows bilateral asymmetry. He starts noticeably at all sudden or sharp sounds. He cannot carry an easy tune, and cannot write without making numerous blotches on his paper.

E. Age, 10 years 8 months. Weight, 55 lbs. Father a respectable Irish laborer. In good health, but undersized. In 5th grade at school. Gets lowest grades in arithmetic and highest in history and geography. In most of the mental tests he ranks below the others of group I, especially in mathematics and the puzzles. Does well with the fables. Is diffident, seldom speaks except when spoken to. Has large and expressive eyes. Is quick to catch explanations, but careless and inaccurate in all his work. Is slightly nervous and exhibits more automatisms than the subjects of group II. Employs rather childish expressions in the written exercises, seen especially in connecting together many sentences with "and." Rather intermittent attention.

F. 10 years 7 months old. Weight, 61 lbs. Father a respectable laborer. In good health. Has attended school 3½ years and is in the 5th grade. Gets "excellent" in all his school studies. His teacher testifies that he does not play boisterously at school like the other children and that during study hours he hardly looks off his books. When his lessons are done he reads. Ranks next to the lowest of group I in the puzzles. He is timid and reserved. Voice is hesitating. Facing a puzzle places his mind in a queer state self-consciousness and embarrassment. He says they make him "nervous." At such times his eyes assume a blank expression, and he seems distracted and unable to pull his thoughts together. The condition is a kind of *intellectual aboulia*. The flow of ideas seems to cease. Takes highest rank with cup and ball, is a swift runner and good at marbles. He is ambidextrous, throws with left hand but writes with the right.

G. Age, 11 years 5 months. Weight, 73½ lbs. Father a respectable Irish laborer, of more than average intelligence. Mother hysterical. Is a younger brother of *N*, but two years beyond him in school work. In school 6½ years and in eighth grade. Ranks uniformly high in all his school work as well as in all my mental tests. In latter is second only to *B*. Has had very narrow experience, never outside of the city of Worcester. Is not willing to leave his books long enough to help his mother with the chores, but leaves them for his brother, *N*, to do. Assumes a kind of guardianship over his older brother, *N*, when they visit my house together. Greatly interested in history and in current events. Logical and clear headed.

H. Age, 13 years 5 months. Weight, 84 lbs. Of a poor Swedish family of little culture. Hearing only ¾ normal. One eye astigmatic so as to be useless for reading. Only in the sixth grade and ranks uniformly low in all his school studies. Better than his group in invention and chess but very low in all the other mental tests. Has played checkers a great deal and his high rank in chess is probably due to this. Has read but three books and can tell little about these. Is good in the motor tests. Has done several kinds of work and plays baseball and football. Is a good swimmer. He is gruff, stolid, obtuse, apathetic, heavy. Very seldom laughs, talks little, and betrays few interests. Never begins a conversation with me and never talks confidentially. Says he will quit school this year and go to work.

I. Age, 10 years 4 months. Weight, 64 lbs. Father a respectable English laborer. Health good. Is in the 5th grade at school. Below medium in all his school work. Has read only two books. Uniformly poor in the mental tests. Shows a preference for the physical exercises. Is active, likes games and is apt at ball and marbles. He is neat in his person and work. He is quiet, reserved, talks little. Speech is hesitating and voice low. Little enthusiasm.

J. Age, 10 years 9 months. Weight, 109 lbs. Obese. Father a policeman of little culture. Irish descent. Health good, but he wears glasses to correct astigmatism. In the fifth grade at school. His teacher finds him extremely dull in all his work, untruthful, resentful, quarrelsome and incorrigible. On the playground he seldom joins with others in the games but prefers to lounge about with one or two companions. Very low in all the mental tests except invention. Fair motor ability. In his apathy much like *H.* Facial expression is stolid, blank, indifferent. Has only read three books. Was never out of the bounds of the city. While belonging to the same general type as *H*, is of decidedly higher grade of intelligence.

K. Age, 10 years 11 months. Weight, 62 lbs. Of an uncultured Swedish family. Health good, but teeth decayed. In 5th grade at school. Teacher gives him lowest rank in all his school work, says he is dreamy, fails to hear or to comprehend her directions, shows little curiosity, troubled or disturbed by nothing, lies, steals, cheats and has little sense of honor. My observations agree with the above. More than once his speech betrayed his low grade of moral concepts. At one time he related without any apparent shame how he "nearly beat the head off" his younger brother because the latter refused to deliver his newspapers for him. When asked if it was right to do that, he answered in the affirmative, on the ground that his brother should have obeyed him. High rank with the cup and ball but low in all the mental tests.

L. Age, 12 years 5 months. Weight, 78 lbs. Father an English laborer of little culture. No noticeable physical defects. In 6th grade at school. Does fairly good work in history and geography. Has read about a dozen books. In the puzzles and in use of language ranks far above his class. Often gave evidence of a certain shrewdness. Not emotional like *C* or *D* and yet not stolid like *H* or *J*. Plays many games well. Specially apt at ball and marbles. Has had much experience in caring for animals, as his father breeds dogs, goats, hares, ferrets, guinea pigs, birds, cocks, etc. He leads an outdoor life and is fairly observant. Not unusual in appearance and his reaction to the tests would lead one to expect from him better school work than his teacher finds.

M. Age, 11 years; weight, 68 lbs. Of well to do and cultured family. No noticeable physical defects. In 5th grade at school. Takes extremely low rank in all his studies, except that he takes pride in the neatness of his written work. Has read only three books and does not like to read. Does, however, like to be read to, and his mother has indulged him in this a great deal. In disposition he is quiet, unemotional, and seldom laughs. He plays games in a half-hearted way and has few close friends. He is an only child and prefers to be alone, often sitting quiet for hours with blank expression. Gets interested in certain simple games (usually such as require little physical movement) and busies himself at them for periods that would bore most children. Health seems good, but physical energy is apparently deficient. All his movements, whether mental or physical are slow. Exasperatingly slow to comprehend explanations. Goes about everything so deliberately as to make one wonder whether he

has any perception of the passing of time. Neat in person and of good appearance.

N. Age, 13 years 9 months. Weight, 81 lbs. Hearing only ½ normal. Brother of *G*. In sixth grade, though he has attended school since the age of 4 years. His teacher finds him the most stupid pupil she ever had. Uniformly poor in all his studies. Never read a book. Says he can't get the meaning. Enjoys very much having his younger brother, *G*, read to him. *G* has read several books to him and *N* takes great interest in them. Normal, if not super-normal, memory for stories heard. His mother says he remembers better than *G*. In more than one respect *N*'s ability is puzzling. He is almost totally unable to read or spell and yet he has a fairly fluent command of spoken language. He also ranks outside his group in the ability to interpret fables. Greater age may contribute to this result but will not account for it in full. *H*, of nearly equal age, ranks 14 in the fable test. According to his teacher, *N* is stubborn, high tempered, easily offended, and childish in his play. My own observations confirm this. He realizes that he is duller than other children. The father, when trying to teach him, gets impatient and calls him a blockhead. At this the boy goes to another room and cries. Interests extensive enough, but shallow and lacking permanence. He stands in interesting contrast with *H* or *M*. The latter belong to Kraepelin's dull type of sub-normal mentality, while *N* is a good example of the lively type. He has good facial expression and is handsome. In movements he is rather awkward. He is a confirmed bed-wetter.

XII. Summary and Remarks.

1. The following table represents the ranking of each subject in each group of tests.

Table XIII.

Ranking on All Tests.

	Invention.	Logical processes.	Mathematical ability.	Language.	Interpretation of Fables.	Chess.	Memory.	Cup and Ball motor test.
A	10	5	1	6	8	7	6	13
B	1	1	1	1	1	1	3	12
C	4	3	4	3	2	2	2	11
D	3	6	5	4	6	8	4	14
E	9	8	7	8	4	6	10	10
F	7	4	6	4	6	5	5	1
G	2	2	3	2	3	3	1	8
H	5	10	10	14	14	4	14	2
I	11	12	12	10	9	11	13	5
J	7	13	11	9	12	10	11	7
K	13	14	12	12	10	13	9	3
L	5	7	8	6	13	9	6	4
M	14	11	14	13	10	14	11	6
N	11	9	9	10	5	12	8	9

2. Group I is superior to group II in all the mental tests, and inferior in the motor tests.

3. The superiority of group I is about the same for all the mental tests except those coming under the head of invention, where it is less.

4. On the whole, the standing of the individual subjects through the separate tests is strikingly uniform. This is only another way of saying that intelligence in these subjects does not show a decided tendency to develop along special lines.

5. Group II discloses no inferiority to group I in the amount of persistency with which problems are attacked. On the contrary, *H*, *J*, and *M* are among the most persistent workers, while *A*, *C*, *D* and *E* show more fitfulness and spurtiness. The latter, to be sure, usually accomplish more in a short period of time than the former in a longer, but their attention is more easily distracted. They more often interrupt a solution to talk of foreign matters, or to engage in some other unrelated activity. The respective methods of work indicate on the part of the latter mental associations that are more volatile, more spontaneous, and based on more subtle resemblances; on the part of the former, associations that are close, matter of fact, and labored.

6. All the subjects were asked (individually of course) whether they preferred to read or to play games. With the exception of *E*, who gave an uncertain answer, all of group I replied that they preferred reading. Every subject of group II preferred games. It would be interesting to know how much a certain innate aversion to physical exercise, or even a lack of encouragement of the same, due to pecularities of the environment, might contribute to the building up or even the creation of interests in such affairs as school work and books. The reverse possibility is also worthy of investigation.

7. Indications of emotional differences, noted elsewhere, are striking and are no doubt closely bound up with the observed intellectual differences.

8. While offering little positive data on the subject, the study has strengthened my impression of the relatively greater importance of *endowment* over *training*, as a determinant of an individual's intellectual rank among his fellows.

In closing, I take pleasure in expressing my great obligations to Dr. E. C. Sanford, not only for assistance throughout the study but also for careful criticism of the entire manuscript To President G. Stanley Hall, and Dr. W. H. Burnham, I am indebted for frequent counsel and advice; to Dr. Fred Kuhlmann for able assistance in the tests, and to him, as well as to Dr. G. E. Partridge, for many suggestions in planning the study

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Vol. 6. Les enfants anormaux. pp. 282.
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Reviewed in Ped. Sem., June, 1906. Vol. 13, pp. 255-256.

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LITERATURE.

Die Experimentelle Pädagogik, Begründet u. herausgegeben von Dr. W. A. Lay u. Dr. E. Meumann. O. Nemnich. Leipzig.

This is practically a quarterly journal, which is just finishing its second volume. It is an organ of a society devoted to the subject of experimental didactics and the education of abnormal children. It is edited by Dr. W. A. Lay of the Karlsruhe seminary and by the well known professor of psychology, Meumann of Zurich, now of Königsberg. The journal marks a distinct advance in the great work of placing education on a scientific basis. In one interesting article Lay urges that already before the establishment of his journal and of the society it represents, this new movement made the philosophical pedagogy as represented by Herbart and Ziller entirely obsolete. The work that the metaphysicians thought was thoroughly done has to be begun again from the very bottom in his opinion. Indeed, so emphatic is Lay's condemnation of the older authorities that he has been sharply brought to book by an able representative of the old school pedagogy of Germany, who insists that all pedagogic experiments are for the most part only frills and affectations of science, that most of them are only very partial aspects of this work.

Of almost equal significance is the founding of *Aussage* by Stern, which we might say is devoted to truth or to the measurements of the accuracy of observation and of description of events. The many technical articles that have been printed here concern themselves with showing pictures or performing actions before children, exhorted before to observe carefully for a limited time, and then having them reproduced in words. The errors are a rich mine and of the utmost practical consequence for the object-lesson method, for every demonstration, for testimony, for the legal age at which a child can bear witness in court, etc. This is another recent movement in Germany which we must reluctantly confess threatens, as does Lay's experimental movement, to take the leadership in child study from this country. If we add to this the third excellent German journal entitled "Eos," with a galaxy of authors and devoted solely to the study of defectives, which is better than anything yet produced in English, we shall experience more keenly the mingled feeling of pleasure at progress and regret that in these respects American investigators are no longer in the van.

In the introduction to the first number of Die Experimentelle Pädagogik, Meumann says that the origin of the development of experimental pedagogy is very like that of experimental psychology. The first experimental pedagogy was more or less hygienic and pertained to health and fatigue. It was represented by Sikorsky (1879), Burgerstein (1891), Laser (1894), Griesbach (1895), and many others since. Somewhat on this basis arose the sense of need of separating feeble children from others in school and this led to the various studies of ability which to-day loom so large in the field of experimental pedagogy. Another contribution came from studies of insanity and yet another from psychology. The technique and economy of learning has been considerably developed for reading and writing, although many of these studies have been made upon adults (see Müller, Stef-

fens, Pentschef, Meumann, Wundt, Cattell, Zeitler, Erdmann and Dodge, Messmer, etc.). Another source is child psychology in the narrower sense. Especially valuable studies have been made in child language, also in the measurements of psychic time, such as rapidity of work at different hours of the day, its relation to fatigue, etc. Another development is marked by Stern, Wreschner and others who have shed so much light upon the accuracies of observation, memory and reproduction and its relations to age, sex, culture, etc. This has an immediate bearing upon object lesson methods of teaching. Everywhere we see the tendency of separating pedagogical and psychological experimentation. Fatigue studies have interested physiologists and psychiatrists; the studies of language have interested philologists; differences of ability interest parents and teachers, and we have valuable studies of memory, and Mayer and Schmid have studied the relations between individual and collective work and between work at home and in school. Lay has given special attention to the elements of arithmetic and orthography. Just what the position of this new departure is in relation to science, to pedagogy, and how independent it is, what should be the proportions of general systematization and detailed technique and accumulation of facts, all these may be left undetermined for the present. Experimental pedagogy is above all things empirical. Seyfert (Die Pädagogische Idee, Leipzig, 1904) makes an original contribution to the goal of education in calling it Durchgeistigung. Now only contributions can be made. We would not concern ourselves with the criticism once made against psychology and physiology that the word "experimental" merely designates a method, nor that it is merely applied psychology. James says it has little to expect from psychology. Meumann thinks it has very much and pleads that pedagogical experimentation is slowly making itself quite distinct from purely experimental psychology because its problems are more complex and are made with practical ends in view. The social aspect of pedagogy is important, but subordinate. Experimental pedagogy does not seek always to reduce all questions to their most elemental form. It is synthetic while psychology is analytic. Its end is not theoretical knowledge of the soul. Individual psychology is on the whole more important than social. Society is an abstraction. It is apparent in Bergemann's treatise that it often rests only on constructive metaphysics, and Natorp shows how it often issues in and rests upon vacant generalities or erroneous affirmations. Of course we must study the social milieu, occupation, the effects of wealth, country and city, co-education, confessional schools, the development of concepts in the child mind comparatively and statistically, and this is in some degree social.

Lay attempts to explain the confusion of pedagogic thought in the past as partly due to the introspective habit which, *e.g.*, made the view of Diesterweg's, whose mind was the acoustic type, while Bormann, his chief antagonist, was eye-minded. Each represented the views that were inevitable for his own mind so long as introspection was the muse of psychology, instead of the observation of children. It is closely related to school hygiene, and to national economy because it seeks to save the most precious of all capital. There must be pedagogical laboratories, and there are in Europe only four; viz., at Zurich, Antwerp, St. Petersburg, and Budapest, the first under Meumann, the others respectively under Schuyten, Netschajeff and the neurologist Ranschburg. There have been the usual objections, criticisms and lack of interest. Didactic experiment is exact school practice controlled by tests and statistics, so that results can be compared.

One of the interesting problems now under investigation by Wal-

leser is on the unification of the methods of teaching modern languages. Here there is at present no end of confusion and conflict of methods. These experiments seek to lay the foundations of some kind of harmony deep and strong by determining for various ages the proportion of acoustic, optical, motor and mixed types of mind. On the basis of this it is hoped methods that are not only unitary but that are demonstrably most economic will be agreed upon.

As to the old Herbartian pedagogics, teachers ought to read and ponder the work of Sallwürck, entitled "The End of the Ziller School" (Zur pädag. Zeitgeschichte, 1904), whose contribution is summed up in the following sentence of Lay's: "However the Herbartians answer in detail the chief points of the criticism of Sallwürck, it is certain that the psychology of Herbart and his pedagogic system and that of Ziller must be now regarded as no longer correct and they must be rejected as the foundation of psychology, pedagogic study and research."

Populäre Schriften, von LUDWIG BOLTZMANN. Johann Ambrosius Barth, Leipzig, 1905. pp. 440.

This is a remarkable collection of twenty-three papers by one of the leading physicists of the world, head of his department in the University of Vienna, and is dedicated to the manes of Schiller, "the unsurpassed master of the description of genuine inspiration true to nature and coming from the depths of the heart one hundred years after his entrance into immortality." The versatility of the author's mind is shown by the great variety of the subjects treated, Maxwell's theory of electricity, the nature of energetics, atomism, the Röntgen rays, together with a discussion of the character and work of Kirchhoff, Stefan, Loschmidt, Schopenhauer, Vaubel, with controversies with Ostwald, account of flying machines, etc. It is a book that really ought to be translated and shows a new side to this great master in his field. The last paper, entitled "The journey of a German professor into El Dorado," tells in a breezy way how one evening after attending a meeting of the Academy in Vienna, he started to San Francisco to lecture at the State University of California. Although he had been in this country before to attend the tenth anniversary of the founding of Clark University, he was again impressed by the high buildings and the intolerable noise of New York, the extortion of the cabman, etc. During his stay in California he made a visit to the Lick Observatory and to the Leland Stanford University; was the guest of Mrs. Hearst, the patron saint. He was made sick by ice-water and humiliated in his efforts to get wine, not only in the transit of trains through states which forbade its sale, but by the secrecy with which he must take it in Berkeley. He records many humorous incidents due to his imperfect knowledge and worse pronunciation of the English language, which he evidently deems the most illogical in its structure and the most impossible of pronunciation of any tongue. He declares that if he had had to make love to his wife in English and said "Ei lowff ju," she would have run away as hens flee from a roaring bull. He narrates how on the long trans-continental trip in American Pullmans with such names as St. Jezabel, Pembina, Vernedal, and the rest, he sought to bewhile the tedium complimenting the baby that lay in the seat in front of him by saying to the mother that her infant looked "äs de tscheild tschises kreist" (as the child Jesus Christ), and that the poor mother was terrified without understanding his attempt at a delicate compliment. He complains that when he had to choose between travelling with closed windows in the extreme heat and becoming as black as a porter from the dust and smoke if the windows were open, he was not allowed to choose the lat-

ter without great difficulty and could not make himself comfortable because a lady occupied the section across the aisle. Very humorous is his description of a dinner with Mrs Hearst, the Alma Mater of Berkeley, and how he incurred her evident displeasure by declining the first course of raspberries and even the melons that she herself sorted for him, and then the oatmeal that "Vienna geese" could scarcely eat. After the meal they proceeded to the baroque salon, where he was asked to play upon an elegant piano, the tone of which quite charmed him. He rejoiced to find an elegantly carved guardian angel over his bed which he fancied suppressed at least for that night the asthma from which he was so prone to suffer. "Every room in the university swarmed with ladies whose hats where everywhere—in the washrooms, on the telephone, in the dark chambers; and his own lectures on physics competed with those of Miss Lillian Seraphine Hyde, "eine nicht unebene Dame," who was lecturing on the preparation of salads and deserts. He describes the Leland Stanford University, and says that after the death of their son, Mr. "and especially Mrs. Stanford fell into a kind of religious Wahnsinn." In Europe he delares when an aging lady becomes over tense, she buys a dozen cats or a parrot, but here she calls an architect of the first rank and builds a university that is certain to be a blessing for future generations. After the death of her husband, Mrs Stanford was for a long time alone in the University. He narrates that when one of the professors of economics spoke out against great financial frauds, "the president thought to placate Mrs. Stanford by promptly discharging this professor, but she was 'so mettlesome' that she called him back and reproached the over zealous president." This is probably a Berkeley version of history. His English teacher had not made his pronunciation perfect, and on one occasion he became very hungry and asked in as many ways as he could imagine, that he be kindly informed at what hour and place he could obtain lunch. No one understood what he said, and after varying the phrases and the pronunciation many times and on many individuals and receiving only a gurgle in reply, his appetite got the best of him and he changed his tactics and cried out loudly in the hall, "Lönch, lanch, lonch, launsch, lownch," exhausting every vowel sound in his vocal font. At last one of the many faces turned in wonderment toward him, understood, and said, "Ah, he means 'lunch,' and he then received the necessary directions. All of which shows that, if the author had not been a great physicist, he might have rivalled Mark Twain (as in Innocents Abroad) as a humorist; for he certainly shows a gift of drollery that is remarkable in a Teuton.

Proceedings of the Twenty-Third Annual Meetiug of the Lake Mohonk Conference of Friends of the Indians and Other Dependent Peoples. 1905. Published by the Lake Mohonk Conference, 1905. pp. 228.

How much better the meetings of this association might be made if, instead of so many professional reformers and long-distance talkers, the doors should be opened to those who know the Indian professionally. We have never been able to understand the tabu placed upon the members of the Ethnological Bureau in Washington who have spent their lives in trying to understand the Indian and whose conclusions as to how to train him are not those of mere philanthropists, but of experts. The conference at this famous temperance hostelry, held in the fall and attended by those guests whom the landlord chooses to invite as the season wanes, and which has made his inn known to many who would not otherwise have heard of it, does not rep-

resent the most advanced thought on the treatment of the Indians or other primitive people. This ought now to be plainly said and is coming to be more and more widely understood. Without the slightest disparagement of the many excellent, intelligent and very useful citizens who have gathered at these meetings, and cordially recognizing that they have done much to make the Indian problem prominent and to interest the public in a certain way and in a certain degree, it has nevertheless become an essentially doctrinal institution. It is already a grave question whether the imposing consensus of the semi-competent who gather here is not rather intimidating the real progressive movement that is now represented by so many experts. For our own part, we think the time has come when the latter should be gathered in a separate conference in order that the progressives may themselves arrive at a settled consensus as to what is practical. The official or government view of the Indian is very different from that taken by the ethnologist, and many are asking with inceasing insistence why we should spend such vast sums in the scientific study of the Indian and not put the results thus gained in practice, or, in other words, why there is so high and tight a wall between the department of ethnology and the Indian bureau. In other lands each of these sheds light upon, if it does not guide, the way to the work of the other, and this is as it should be.

Die reifere Menschheit, von LEO FROBENIUS. Gebruder Jänecke, Hannover, 1902. pp. 464.

This author again appears with another book for children, so fascinating that he must be ranked among geniuses in conserving in himself the child he was and in being able to open new fields of fascinating interest not without profit to children. This book contains nearly six hundred cuts, which are grouped about seven great themes. First comes the inexhaustible legends about Reynard the Fox, of which it is said there were in the middle ages over a thousand editions printed, more than of any other book. He traces the roots of this story from Japan westward and shows how many other animals have been cast in its rôles. The second theme is on the war of animals and of good and bad men. As the former theme was the last utterance of the old and once far more prevalent under fable, so this shows the development of the culture fable. Here, too, many animals and types of men and even trees and flowers appear. The animal myth in its decline is also shown here in many forms. Then comes the bear festivals, also universal and manifold, but with fundamental unity of form and interest; fifth, the hunting stories, with no end of traps, pitfalls, hunts of different animals by tribes, civilized men, kings and emperors, and with illustration of hunting life in antiquity, especially Egypt. Then comes the great theme of the war between animals and man; how the enmity arose, how it was expressed, how man slowly made himself lord of the animal kingdom; and lastly the story of a truce and then friendship and at last domestication. The last chapter is entitled "Human culture and the highest values." This is devoted largely to education among savages and that of Egyptian, Chinese and other monarchs, and sheds light from new sources upon the history of education.

Pflanzer und Jägerleben auf Sumatra, von EDUARD OTTO. Wilhelm Süsserott, Berlin, 1903. pp. 185.

A German hunter visited Sumatra and, obtaining a license to hunt, proceeded to shoot almost everything that came in his way,—elephants, rhinoceroses, orang outangs, bears, leopards, snakes, argus hens and many other birds of beauteous plumage. He has himself

photographed in the act of shooting, arranges his trophies, photographs himself beside the corpses of his victims, and gives us pictures of his rifle, his pitfalls, his hunting attendants, himself in his tent, enjoying choice brands of wine and beer, etc. Judging from this book, there was no scientific, commercial, or any other purpose of his trip that was dominant save only the lust to kill, which here has one of its most offensive and barbaric illustrations. He does not appear to be even a collector for any one but himself, and there is indirect evidence that he does not even understand the best methods of preparing his pelts or mounting his birds. Such a book seems to be in diametrical opposition to the new spirit of sympathy for the more important, larger, and beautiful forms of animal life now so fast vanishing from the world.

Educational Work. Edited by W. H. Holmes, Jr. Vol. I, No. 1, Jan. 1906, pp. 47; No. 2, Feb., 1906, pp. 51-96; No. 3, Mar., 1906, pp. 97-144; No. 4, Apr., 1906, pp. 145-192. Published by the Educational Work Company, Worcester, Mass.

Educational Work represents the Batavia system, which strives to make headway against the appalling fact that in certain states nearly fifty per cent. of the pupils enrolled in the public school never get beyond the fourth year's work. The nation ought to rise and ask the reason for this condition. The Batavia system is an effort to combine class with individual work. We do not think its author has ever given quite sufficient credit to the pioneer work which Superintendent Search did first at Pueblo and later at Holyoke. In the latter place the system was combined with election in high school grades in a very interesting and suggestive way. This journal is devoted to the interests of individual instruction in different departments of study. While this is the core, it discusses very many other themes, especially those which have as their general aim the keeping of boys in school. It seeks also to keep tab upon the different methods of individual work in various places where it has found more or less ingress. Batavia has won much renown and attracted countless visitors, and the superintendent has been sagacious enough to magnify his work, and that in a wholesome way which deserves on the whole more and not less attention than it has already received.

The School and its Life. A Brief Discussion of the Principles of School Management and Organization. By CHARLES B. GILBERT. Silver, Burdett & Co., New York, 1906. pp. 259.

Here we have one of our most successful American superintendents collecting the results of his experiences in two dozen brief chapters on such topics as the morale of the school, the individual child, department teaching, grades and promotion, freedom of the teacher, teachers' meetings, preparation, the superintendent, principal, legislation, relation to the home, etc. The chapters are unpretentious and unstudied. There is no display of erudition in learned footnotes or references, but the author has evidently attempted to put in concise form the faith that is in him and the general experiences of a life very rich educationally. The author is not only one of the most able, progressive, and in every other way admirable superintendents America has yet produced, but he appears to his friends to have been the victim of one of the most atrocious, persistent, and probably baseless persecutions to which any man was ever subjected. That despite all this he should have maintained his personal happiness and complete philosophical repose shows qualities that rank even higher than those of a successful educational administrator. There is, of course, no trace in any way of all this in his book.

Pflege und Entwicklung der Persönlichkeit, von Prof. Dr. LUDWIG GURLITT, Oberlehrer am Gymnasium zu Steglitz. R. Voigtländers Verlag in Leipzig, 1905. pp. 53.

This little book contains the address on "Personality," which so stirred up the German philogists and teachers at their forty-eighth session at Hamburg, arousing, especially, the opposition of those who deny the possession of personality to children, youths and maidens, and even to women. It failed to please also the ultra-pious, whose ideal personality is the devout Christian, and who were shocked at the thought that childhood might have a personality all its own, the unity of all child-qualities in their completion and peculiarity as such, — a personality quite as wonderful as that of the man. They who have been so long accustomed to see personality only at the goal of human evolution could not easily be brought to perceive it in the golden beginning. They forgot that each epoch of the life of man has its own personality, of equal value, too, with the others. They denied personality to the child, and yet were staggered by the request to determine the age at which a Luther, a Goethe, a Schiller, a Bismarck became personalities.

Professor Gurlitt's word is one of the most inspiring that has come from over-sea for a long time. It makes the dry bones of certain "child-study" sepulchers rattle to the cry, "Be not afraid of the child; he is, indeed, the very father of the man." Outside of sickness and disease, the child is good, as the race is. It has its own personality, as have the races, for it is older than they, and bears in itself more of the might of heredity. The Hebrew and the Negro go back beyond the Pyramids and the records of Babylon, but the child began ages before them. Its instincts, some of them at least, are older than man himself. If it does not grasp life and the things of life with adult senses, it has Argus eyes and Gygean hands that see and touch the whole world. By virtue of its own peculiar personality the child is capable of doing instinctively and greatly much that man accomplishes only with much labor and distress.

It were folly for the teacher to ignore the personality of the child, and to try to shape it after some adult-chosen norm or model,— "the 'good' normal child is about as unpersonal as a trained poodle." The child personality should be the basis of all education, and the teacher must be a personality in order to educate another personality. The teacher must remember, too, that personality has really little to do with knowledge and so-called culture,— it is greater than either and begins before both. But, more than all, childhood has something in greater degree than all other epochs of life. With double force we can apply to it the words spoken by Grillparzer of youth: "Age. . . . has knowledge and wisdom, but childhood is holy."

This appeal for reverence for the personality of the child ought to be read by every parent and by every teacher. In the child we face the most gracious personality human evolution has so far created, and such marring as falls to its lot is largely "the invention of men."

ALEXANDER F. CHAMBERLAIN.

Lessons for Junior Citizens, by MABEL HILL. With an introduction by Albert Bushnell Hart. Ginn & Co., Boston, 1906. pp. 234.

Professor Hart, who is sponsor for this book, as for so many other things of a very varied character, thinks young children, especially boys, ought to know more about the local government under which they live; that they should be taught much about tricks and thoughts that are too common, and that as the subject is not of thrilling interest in itself it should be put in story form, and everything should be

copiously illustrated; that there should be a special glossary explaining such words as adult, arrest, athletics, bail, catch basin, code, court, drainage, felony, parks, police, statuary, treason, test, tramp, tunnel, trial, verdict, witness, and many others. Photographs are of great conventions, of sample immigrants, old-fashioned houses, streets, country town meetings, dams, good and bad homes, truant bedrooms, school gardens, playgrounds, dumpers, street cleaning, a fire, etc. It is a good book, without doubt, in its idea, but the story method of its execution seems to us to be fatuous and pedagogically absurd, incumbering the virtue there is in it all, and that to a high degree. The quality of the pictures might easily be improved, but the thing chiefly needed is the plainest, most condensed, objective statement of facts and not a cumbersome twaddle story incorporating them. Cannot the book be revised and more information incorporated in less space?

Luminous Bodies Here and Hereafter. (The Shining Ones.) By CHARLES HALLOCK. The Metaphysical Publishing Co., New York. pp. 110.

This member of the Washington Biological Society here seeks to explain "the inter-relation of the intellectual, celestial and terrestrial kingdoms and of man to his Maker. He begins with a poetical invocation, and in the second chapter entitled "L'Envoy," claims to start from H. R. Rogers' theory of physical force, illustrated by Oliver Lodge's corpuscular theory. He then discusses vito-magnetism and soul-aura; then tells us the color effects of the emotions; describes the electrical body of the future life and supreme force and its potential agent, the philosophy of eternal felicity and of religion; discusses the relation between evolution and the future life; and ends with a creed a prayer and commendatory letters from various writers. All in all, it is a strange melange of oriental ideas, Biblical literature, folklore and modern science, the general conclusion of which is that electricity confirms the doctrines of Jesus, of the immortality of the soul, Judgment Day, evolution, and about everything else that has been widely and strenously believed, whatever its nature.

Applied Sociology. A Treatise on the Conscious Improvement of Society by Society. By LESTER F. WARD. Ginn & Co., Boston, 1906. pp. 384.

This work with the author's previous publications make up a comprehensive system of social philosophy, the parts of which, we are told, are consistent each with the other and are progressive. It claims to be practical, never losing sight of the end or purpose of conscious effort and is a reaction against the philosophy of despair. It seeks a remedy for the general paralysis creeping over the world and which a narrow conception of the law of cosmic evolution increases rather than diminishes. It would remove the embryo of determinism. If it be objected to this book that it marks little advance beyond the author's Dynamic Sociology, the reply is that there has been little progress in the last twenty-three years, but that most attempts to advance have been virtual failures. Everything rests upon increased knowledge and its socialization and application. The intellectual heritage of mankind must be distributed equally to all. The author has evidently derived a great deal from France, to which most that is new in this book can be traced.

The Olympic Games at Athens, by JAMES E. SULLIVAN. (Spaulding's Athletic Library, No. 273.) American Sports Publishing Company, New York, 1906. pp. 185.

This is a cheap and unpretentious, but really very valuable and

interesting book, copiously illustrated, and gives the reader a very good picture of what actually took place in connection with the Olympic games, beginning April 22nd last, at which Amercans won most prizes. Nearly a hundred thousand people were in or close about the stadium at the opening of these remarkable festivals, which add a great stimulus to sport on the continent and in this country. All agreed that as a whole these exceeded all the other Olympic games, including those at Paris in 1900 and at St. Louis in 1904. The interest which Greece herself takes in these games, and especially in the great Marathon race, is almost pathetic, and there can be little doubt but that the sentiment of the world would have preferred to see Greece herself win instead of coming in fourth and giving the first place to Canada.

Congress of Arts and Science. Universal Exposition, St. Louis, 1904. Edited by Howard J. Rogers. Vol. IV. Physics, Chemistry, Astronomy, Sciences of the Earth. Houghton, Mifflin & Co., Boston, 1904. pp. 759.

The departments contained in this volume represent some of the very best work of the association and bring together some of the most eminent names of foreigners as well as of Americans. Among the former we find such names as Rutherford, Moissan, Sir William Ramsey, van't Hoff, Cohnheim, Zirkel, Penck, Mitsukuri, Arrhenius. One of the most popular and unique addresses is that of the last, describing the artificial cultivation of snapping turtles in farm ponds, in Japan. Not only they, but goldfish, carp, eels, mullets, salmon, oysters, clams and various other marine creatures are cultivated extensively and with profit, and the diagrams explain copiously the methods by which this is done.

Greek Theories of Elementary Cognition from Alcmaeon to Aristotle. By JOHN I. BEARE. Clarendon Press, Oxford, 1906. pp. 354.

This work will be a godsend to all who have to teach or study the history of perception and cognition. The writer has carefully compiled all characteristic utterances of the Greek writers down to Aristotle on vision in the first chapter. He then takes up the ancient psychology of hearing, smelling, tasting, touching, in successive chapters. In the second part he first treats sensation in general, its common and peculiar features; then in the third part the sensus communis, and with this the work ends. Marginal notes epitomizing everything greatly ease the way of the reader, and although the index of topics and of Greek words is carefully made, there is no index whatever of the subjects and chapters. It is a work which ought to be in the hands of every student interested in the subject.

From a College Window. By ARTHUR CHRISTOPHER BENSON. G. P. Putnam's Sons, New York, 1906. pp. 365.

We have here a somewhat quaint collection of what might perhaps be called quiet twilight meditations, by a fellow of Magdalen College, Cambridge, England, who has taught some twenty years and has apparently retired quite out of conceit with his profession because the results of his teaching have been so unsatisfactory to himself. And so he rambles on through eighteen chapters, on growing old, books, conversation, art, egotism, education, authorship, criticism, priests, ambition, the simple life, games, spiritualism, habits and religion. While there is nothing striking in the book, it will be a pleasant pastime for a vacation afternoon and rather suggests a hammock under the trees and the time of day between a hearty midday meal and a siesta.

The Psychology of Reading. An experimental study of the reading pauses and movements of the eye. By WALTER FENNO DEARBORN. Archives of Philosophy, Psychology, and Scientific Methods. Edited by J. McK. Cattell & Frederick J. E. Woodbridge, No. 4, March 1906. Science Press, New York. pp. 134.

This contribution is a valuable scientific document, summing up as it does the results of the experiments, now many, on the physiology and psychic activities involved in the act of reading. This line of work was invested with a sudden new zest a few years ago by the demonstration that in moving along the line the eye leaps and pauses several times in alternation. All these studies have an important bearing upon the practical problem of teaching reading.

Le Réveil au Pays de Galles, par HENRI BOIS. Société des Publications Morales et Religieuses. Toulouse, 1905. pp. 613.

This is a valuable study. It describes first the character of religious work in Wales in general, and gives a sketch of earlier revivals. An interesting chapter is on the cause and antecedents of the great revival of last year. The Torrey mission is described; but perhaps most interesting of all are the chapters devoted to the description of certain individual revivalists — Evan Roberts, Mrs. Jones, Sidney Evans, Joseph Jenkins, and others.

The Transformation of Hawaii. How the American Missionaries gave a Christian Nation to the World. By BELLE M. BRAIN. Fleming H. Revell Co., New York, 1898. pp. 193.

The sixteen chapters of this little book are interspersed with a dozen illustrations, Hawaiian songs, and bring the history of this country down to July 6, 1898, when the islands were formally accepted by the United States. The earlier chapters trace in outline the history of the islands, describe the fire palace of Pele, the work of Henry Obookiah, the story of Kapiolani, the overthrow of idolatry, the great awakening, etc.

F. C. Noll's Naturgeschichte des Menschen. Fünfte Auflage. Besorgt von H. REICHENBACH. Ferdinand Hirt, Breslau, 1905. pp. 120.

This little book is essentially what used to be taught under the title, "Anatomy, Physiology and Hygiene." The title "Anthropology" in the English sense is justified only by the last section which deals with the races of men, their geographical distribution, something of their cult, being, like all the rest, copiously illustrated.

Report of the Superintendent of Indian Schools to the Commissioner of Indian Affairs for the Year ended June 30, 1905. Government Printing Office, Washington, 1905. pp. 34.

The reports of the superintendent of Indian schools are very fond of contrasting the old life of the Indians with their occupations when they have been forced to take up the white man's burden. The goal of the government is to make each Indian boy and girl self-supporting, but even this end it is now certain could be reached by developing indigenous industries.

Standard English Classics Series. Ginn & Co., Boston, 1906.

The Pilgrim's Progress. By JOHN BUNYAN. With notes and a sketck of Bunyan's Life. pp. 119.

Selections from Spencer's Faery Queene. Books III., IV., and V. Edited with introduction and notes by Mary E. Litchfield. pp. 268.

Washington's Farewell Address and Webster's First Bunker Hill Oration. Edited with introduction and notes by Charles Robert Gaston. pp. 62.

The Laurel Music-Reader. Edited by W. L. TOMLINS. C. C. Birchard & Co., Boston, 1906. pp. 186.

First Year German, by WILLIAM C. COLLAR. Ginn & Co., Boston, 1905. pp. 336.

Sixty-ninth Annual Report of the Board of Education together with the Sixty-ninth Annual Report of the Secretary of the Board. 1904-1905. Wright & Potter Printing Co., Boston, 1906. pp. cxxxi and 411.

The Essentials of German Grammar. By ALVAN EMILE DUERR. Ginn & Co., Boston, 1905. pp. 206.

Gravelotte. Chapter XIV of Jörn Uhl, by GUSTAV FRENSSEN. Edited with introduction, notes and vocabulary by Otto Heller. Ginn & Co., Boston, 1906. pp. 67.

Grammar of the English Sentence, by JONATHAN RIGDON. Hinds, Noble & Eldredge, New York, 1903. pp. 300.

Höher als die Kirche, von WILHELMINE VON HILLERN. Edited with introduction, notes, exercises for composition and conversation, and vocabulary, by Clarence Willis Eastman. Ginn & Co., Boston, 1906. pp. 107.

My life. A record of Events and Opinions. By ALFRED RUSSEL WALLACE. Chapman & Hall Ltd., London, 1905. Vol. 1, pp. 435. Vol. 2. pp. 459.

Die Sprachstörungen geistig zurückgebliebener Kinder, von ALB. LIEBMAN. Reuther & Reichard, Berlin, 1901. pp. 78.

Publications of the Association of Collegiate Alumnæ. Series III, No. II, June, 1905. pp. 57. Contents: Contributions towards a bibliography of the higher education of women. Supplement No. 1.

The Spirit of the East contrasted with the Spirit of the West: being a lecture delivered by P. Rámanáthan (Solicitor General of Ceylon) before the Brooklyn Institute of Arts and Sciences at its opening meeting of the season of 1905-06. pp. 32.

Report of the Forty-Third Meeting of the Eastern Association of Physics Teachers, December 9, 1905. Massachusetts Institute of Technology, Boston. pp. 45.

Transactions and Proceedings of the National Association of State Universities of the United States of America, 1904. No. 2. pp. 118.